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With the popularity of specialty coffee at an all time high, why are coffee farmers getting record-low prices for beans?

Trouble brewing

Historic preservation meets the modern office park

How computers affect jobs, skills, and wages

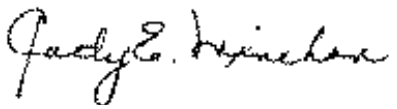
this issue

IT MAY BE TRUE that the only constant in life is change, but adapting to change is one of the more difficult tasks our economy faces. Even when change brings greater efficiencies and a higher standard of living for many, adjustments can be painful and involve difficult choices.

In **Preserving Our Past**, Carrie Conaway considers CIGNA Corporation's plan to redevelop the office park in Bloomfield, Connecticut, which served as its former headquarters. While a number of prominent experts have cited the property as an architectural treasure and historic landmark, today the buildings' outdated design no longer meets CIGNA's need for modern, efficient office space. Conaway highlights the preservationist's dilemma: Which sites should be preserved and who should pay the cost?

Miriam Wasserman examines developments in the coffee industry in **Trouble in Coffee Lands**. Although the U.S. market for specialty coffee drinks is booming, the international price of beans is at a 30-year low. Wasserman argues that while farmers in coffee-producing countries have always been subject to wide price swings, a number of factors that have changed over the past two decades have left them vulnerable, with no easy solution in sight.

Finally, Professors David H. Autor and Frank Levy, of MIT, and Richard J. Murnane, of Harvard, look at how new computer technologies can affect job design, skill requirements, and wage differences among workers. In **Upstairs, Downstairs**, the authors contrast the introduction of imaging technology in two different departments of a large bank. Downstairs, the changes lead to more specialization; upstairs, to more broadly defined, integrated jobs, and a new emphasis on hiring employees with more formal education.



CATHY E. MINEHAN
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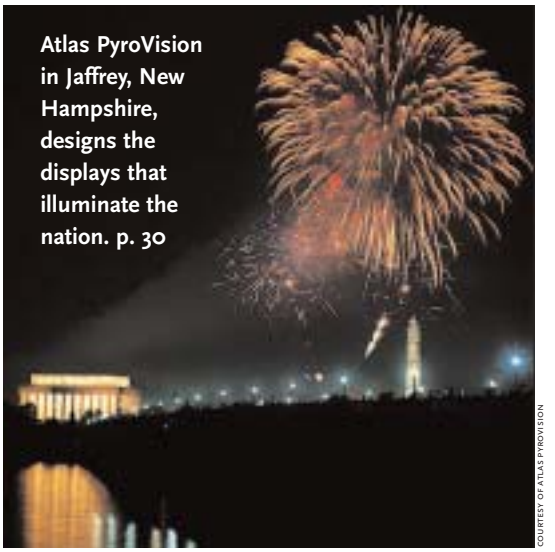


Atlas PyroVision in Jaffrey, New Hampshire, designs the displays that illuminate the nation. p. 30

COURTESY OF ATLAS PYROVISION

COVER ILLUSTRATION BY GREG MORGAN

observations

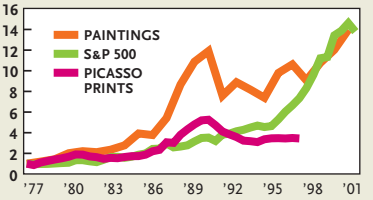
Smart Art

THERE'S MORE TO the art world than pretty pictures. Many prospective buyers consider art an investment. When art prices escalated in the late 1980s, the odds of a favorable return seemed good. "Yo Picasso," priced at $5.8 million in 1981, sold for $47.8 million in 1989; the 1990 $82.5 million sale of Van Gogh's "Portrait of Dr. Gachet" made history as the highest price ever paid at auction. Though this was a high-water mark, savvy collectors Victor and Sally Ganz netted $183.8 million in revenue in one 1997 auction, which was $50 million more than the couple would have earned if they'd invested in small company stocks, and $137 million more than in large company stocks, estimated University of Chicago professor William Landes.

What are the chances for the rest of us? Because artworks are usually one-of-a-kind pieces and change hands so infrequently, average returns are difficult to estimate and vary greatly, depending on the body of works and the time periods considered. On the one hand, using an index of repeat sale prices of paintings on auction at Christie's and Sotheby's, Stern School of Business professors Jiangping Mei and Michael Moses at New York University found promising results. Art generated an average annual return of 8.2 percent over the last 50 years, comparable to the 8.9 percent return on S&P 500 stocks, and was only somewhat more volatile. But in a similar study of Picasso prints, where comparable duplicates enabled a large sample size, University of Toronto professor James Pesando found only a 1.5 percent annual return over the last 20 years, with as much volatility. Furthermore, these estimates may be high because of large transaction costs—auction houses take up to 20 percent of the sale price—and because of a survivor bias—already successful works, like those included in these indexes, may poorly represent the broader pool of not-yet-famous art.

Painting the returns

Index 1977=1



SOURCES: Paintings Index from Mei and Moses, "Art as an Investment and the Underperformance of Masterpieces," *American Economic Review*, forthcoming; Picasso Prints Index from Pesando and Shun, "The Returns to Picasso's Prints and to Traditional Financial Assets, 1977 to 1996," *Journal of Cultural Economics*, 1999; and S&P 500 from the *Wall Street Journal*.

Whether or not art investments can measure up on their own, evidence that they are not very correlated with traditional financial assets suggests they might be useful for portfolio diversification. With this in mind, the British Rail Pension Fund included a relatively successful portfolio of art and antiques between 1977 and 1996. But in Pesando's study, even when diversification is taken into account, the return on art is not attractive enough to significantly improve portfolio performance. A better strategy may be for buyers to take advantage of their own expertise in lesser-known art markets. For example, Pesando himself favors 18th-century American furniture; he might find a deal on a valuable chair at a flea market in Vermont, but there's little chance of finding a Picasso.

Of course, art also provides consumption value. Many buyers are willing to spend more on art than monetary returns alone justify because of the pleasure of viewing the object. Indeed, the vast majority of the Ganzes' 1,000-plus-piece collection remains on their estate. Perhaps the safest bet is to select art investments that buyers actually enjoy—art for art's sake after all. —*Kristin Lovejoy*

Test driving the Internet

Buying a car ranks as one of the biggest purchases consumers make. They invest great amounts of time in researching models and options, not to mention going from dealer to dealer to test-drive and haggle for a reasonable price.

Can the Internet make this process any easier? Numerous websites offer free information on the dealer cost of new cars, trade-in value of used ones, and even dealership inventory. Others, such as Autobytel.com, are third-party "infomediaries." Aside from providing vital statistics on vehicles, Autobytel connects consumers with car dealers. Potential buyers submit a request for a price quote on a specific car—along with their name, zip code, and contact

(continued on next page)

ILLUSTRATIONS BY MARC ROSENTHAL

CONTINUED FROM PREVIOUS PAGE

information—which is forwarded to the dealer assigned to the area.

And customers may be reaping the benefits. Economists Florian Zettelmeyer, Fiona Scott Morton, and Jorge Silva-Risso found that buyers who used Autobytel saved an average of 1.2 percent compared to those who purchased a car through conventional means. The researchers estimate that the savings are even greater—slightly above 2 percent—if the customers who opted for the Internet are those that pay higher prices at conventional dealers (such as those who are poor bargainers).

The researchers found several reasons for the lower prices. First, dealers have a contract with Autobytel that provides incentives to offer lower prices. Dealers are required to have a salesperson who only handles Internet requests and is paid based on sales volume, rather than on the profit extracted from negotiating with each customer.

In addition, some customers used Autobytel but made their purchase at a dealer other than the one they were referred to—and they also received lower prices. This suggests that Internet research makes online consumers more educated about their purchase and, thus, better negotiators. The low cost of searching on the Internet could also expand buyers' options and make it easier to explore distant dealerships and more types of cars in search of a better deal. Or, perhaps a specific price quote from an Autobytel-associated dealer gives them leverage to obtain a better price elsewhere.

Alas, the emergence of the Internet has not made haggling a thing of the past. A recent online buyer found that instead of being given a direct quote on a new car, dealerships invited him to come in and discuss the issue with them. According to JD Power and Associates, 14 percent of dealers associated with Autobytel will quote a discounted price by email or phone only if the customer insists, and 2 percent won't give quotes at all until the customer comes to the dealership.

—Jennifer Duval

PLEASE WRITE TO US

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perspective

Tobacco manufacturers are now compensating states for smoking-related costs. How will this affect the economy?

By David M. Cutler, Jonathan Gruber, Raymond S. Hartman, Joseph P. Newhouse, and Meredith B. Rosenthal

SMOKING COSTS THE Massachusetts Medicaid program money. The more people smoke, argues the Attorney General's office, the more the state spends on Medicaid to pay for smoking-related illnesses. To recoup these costs, the Attorneys General of Massachusetts and 45 other states took the tobacco manufacturers to court. In November 1998, cigarette companies agreed to pay out $104.7 billion in damages through the year 2025—the largest sum of money paid in any civil litigation in American history. The master settlement agreement (MSA) requires tobacco manufacturers to pay reparations for states' Medicaid expenses, totaling up to $9 billion per year. They must also sponsor several billion dollars' worth of anti-smoking advertising and education over the next ten years and must restrict their advertising in public places such as outdoor arenas and public transit. The cost will be covered by a 45 cent per pack price increase on cigarettes, which was put into effect immediately following the settlement.

What are the economic impacts of the settlement for Massachusetts? The most obvious is an increase in state revenues; the MSA will net the Commonwealth an estimated $4.2 billion in revenues over the next quarter-century, roughly 2 percent of total tax receipts. But, while this will be an important source of funds to cover the state's smoking-related expenses, it doesn't lead to a net gain for society since it simply represents a transfer of resources from one group (future smokers) to another (all the citizens of the state). The benefits to society depend on how much smoking rates decline due to the agreement, and on assumptions about why people start smoking in the first place.

THE SOCIAL PAYOFF OF IMPROVED HEALTH

How big a social benefit we reap is determined, in part, by how the settlement influences smoking behavior. First, the 45 cent per pack price increase raised the cost of cigarettes by about 15 percent per pack. This is likely to reduce tobacco consumption since as the price of cigarettes increases, smokers cut back and nonsmokers are less likely to start smoking. In fact, recent research shows that the 15 percent price increase should lead to about a 5 percent decline in smoking participation among adults. Estimates of the impact of the price increase on youth smoking are somewhat more difficult to quantify and range from zero to about 6 percent. The anti-smoking advertising campaign should also cut smoking rates; other experiments with this type of advertising have yielded a 5 percent or greater reduction in smoking. The

new restrictions on advertising in public places, however, are unlikely to reduce smoking since there is no constraint on the tobacco industry's increasing advertising expenditures in other venues in compensation. With all these effects taken together, and after adjusting for the overall decrease in smoking rates, the settlement means 11 to 13 percent fewer people in Massachusetts will smoke in 2025 than today.

The less people smoke, the healthier they will be—but what does this mean for society? Improved health will translate into lower Medicaid spending, savings which directly benefits taxpayers. Without the MSA, Massachusetts would have spent about $7.2 billion on smoking-related illnesses by 2025; as smoking declines, so will these costs. In the end, the MSA will save Massachusetts approximately $65 million in Medicaid spending by 2025.

But even more important, the extra years of life gained by not smoking also have a value to society. In Massachusetts, the MSA will reduce the number of adults who ever smoke by about 45,000 and the number of youth smokers by anywhere from 2,100 to 13,000, adding an average of six years of life per person. These reductions in smoking will save approximately 550,000 life-years. Measuring the economic value of these life-years saved is a challenge, but economists have developed several techniques to estimate this figure. One is to survey people about how much they would be willing to pay to reduce their probability of dying. The other is to measure the increase in pay associated with performing high-risk jobs, called a compensating wage differential. The relationship between the increased risk of death and either increased wages or willingness to pay can then be used to calculate the value of an additional year of life. Employing these techniques, we estimate that the 550,000 life-years saved by the agreement will yield between $43 billion and $87 billion in social benefits through the year 2025—hundreds of times the savings from reduced Medicaid spending.

This means, for every dollar transferred from cigarette companies (and future smokers) to the state, the social benefits from reduced Medicaid spending and improved health will amount to $15.50. These benefits would be even greater if we had also included the positive effect of reduced smoking-related illnesses such as chronic bronchitis or emphysema. Some studies indicate that people are willing to pay about $100 to avoid a single day of coughing due to bronchitis, for instance. It's hard to measure these effects due to the difficulties of identifying new cases of disease and of quantifying how much people would be willing to pay to avoid illness. But if these effects could be included, the measured benefits of the settlement would substantially increase.

VICE OR VIRTUE?

But how to account for the pleasures of smoking to the smoker? Some economists argue that smokers must feel that the enjoyment they experience from smoking is worth its price to their health; otherwise they wouldn't smoke in the first place. If this theory of "rational addiction" is correct, then the social benefits of reduced smoking are completely offset by the social cost of lost smoking pleasure. This argument is only convincing, however, if smokers make a rational choice to smoke. But 90 percent of smokers begin to smoke when they are under 18, an age when they may not be capable of making decisions in an adult capacity and when they are overly optimistic about their ability to quit. Furthermore, studies show that smokers tend to underestimate by about 40 percent the future costs (primarily to their health) that they themselves will bear from smoking, making it hard to argue that they are properly accounting for these costs in their decisions to smoke. And the addictive quality of nicotine means that an irrational youthful decision to start smoking, for many, becomes permanent. While it is indisputable that smokers derive pleasure from smoking, they may excessively weight short-term pleasure over longer-term costs. Thus, our estimates show that even if smokers do get some pleasure from smoking, there is still likely to be a substantial social benefit to reduced smoking—and one much greater than the direct payments of the tobacco manufacturers to the Commonwealth's coffers.

SO GOES THE NATION

While our study only examined the effects of the settlement in Massachusetts, the social gains are likely to be similar in other states. The improved health of the population due to decreased smoking, which should be similar across states, accounts for 99 percent of the social benefits. By comparison, reduced Medicaid payments, which vary from state to state, account for only 1 percent. As a result, the nation as a whole can expect to reap 30 to 40 times the benefits found for Massachusetts—an overall social gain in the trillions of dollars. We can be sure that smoking will always have social costs, but the tobacco settlement will help offset them for at least the next 25 years. ✻

David M. Cutler, Joseph P. Newhouse, and Meredith B. Rosenthal are professors at Harvard University. Jonathan Gruber is a professor at the Massachusetts Institute of Technology. Raymond S. Hartman is a special consultant for Lexecon, Inc. The authors' article, "The Economic Impacts of the Tobacco Settlement," appeared in the Winter 2002 issue of *Journal of Policy Analysis and Management.*

ILLUSTRATION BY GENE GREIF

By Miriam Wasserman
Photographs by Kathleen Dooher

trouble in coffee lands

The current crisis is the latest and most dramatic in a long history of

Juan Valdez and his mule are out of business. Coffee prices have plummeted to 30-year lows, hitting a historic bottom of under 39 cents a pound last October. The price drop, 82 percent from just four years earlier, forced the National Federation of Coffee Growers of Colombia to pull the plug on one of the world's most successful marketing icons.

Coffee is not a trivial matter in the developing world. Coffee is the second-largest export earner for developing countries, and is the main source of foreign exchange for several nations, accounting for over half of export earnings in countries like Burundi and Uganda. The situation is placing Mr. Valdez's real-life counterparts under economic hardship. This downturn directly affects approximately 20 million families who live


industry ups and downs

in the world's coffee-growing belt—between the tropics of Cancer and Capricorn—and depend on the beans for their main source of income. In March, the United Nations' World Food Program began an emergency operation to assist 155,000 people in Guatemala where a severe drought that killed subsistence crops coincided with the low coffee prices.

But, for the most part, the circumstances affecting producers have gone largely unnoticed in the United States, the world's largest coffee consumer. Americans have not seen equally steep price declines for coffee in their supermarket aisles. In fact, changes in supermarket prices have been obscured by the much more dramatic expansion in the variety and sophistication of the coffee menu available to ordinary consumers. From the humble cup of Joe sprang the latte, the flavor-of-the-day coffee, and the gourmet whole bean—not to mention the iced moccachino. Going for over $2 a cup in many of its gourmet incarnations, coffee has become an "affordable luxury."

The stark contrast between developments in consuming and producing countries is helping to bolster the arguments for "Fair Trade" coffee: a movement that guarantees small producers a fixed minimum price for their product—between two and three times the unsubsidized market price in the current price slump. By buying Fair Trade coffee, consumers in developed countries can feel that they make a positive difference by ensuring good working conditions and higher prices for farmers in poorer countries. And the firms that engage in Fair Trade also benefit by gaining a public relations advantage. But, though this clearly improves the lot of a small share of farmers, long-term options to protect a larger share of developing-country producers from tanking prices are far more complicated.

Problems in producing countries have gone largely unnoticed in the larg

BETWEEN THE TROPICS OF CANCER AND CAPRICORN

The economics behind the current drop in coffee prices is as simple as the solution has proven intractable: supply far outstrips demand. For the 2001-2002 crop year, for instance, the U.S. Department of Agriculture estimates world coffee production to be almost 116 million 60-kilogram bags, while consumption is estimated to fall short of this figure by around five million bags (about 600 million pounds). And the excess supply is widened by already existing stocks, as green coffee can be stored for up to one year (it quickly goes stale after roasting).

The coffee trade has been particularly hard hit, but it is part of a more widespread phenomenon. The average dollar price of developing countries' non-oil primary commodity exports fell by 9 percent in 2001. While coffee prices were down 30 percent in 2001, cotton prices also declined 20 percent, and rice prices fell 15 percent with respect to the previous year. A global economic slowdown and the existence of large supplies of most commodities were largely responsible for this wider trend.

The most visible factor behind this imbalance in the specific case of coffee is the forceful entry of Vietnam into the trade. "Ten years ago Vietnam was not even a blip on the screen of the world coffee market," says Mark Pendergrast, author of *Uncommon Grounds: The History of Coffee and How It Transformed Our World*. From the backbenches of coffee production in 1990, Vietnam has expanded its production by about 1,400 percent over the decade and, by 2000, had displaced Colombia as the world's second-largest coffee grower after Brazil (see chart, page 9).

Many longer-established coffee producers blame the price plunge on Vietnam's meteoric rise. Some have pointed accusing fingers at the World Bank, claiming that it encouraged the growth of the Vietnamese coffee industry. But the World Bank refutes those accusations. It says it resumed lending to Vietnam in 1994, after the country's coffee expansion was already under way and that, though $16 million from a loan to the Agricultural Bank was used to finance coffee farm rehabilitation, it has not lent directly to the coffee sector. "While $16 million is a considerable sum of money in a poor rural economy, such an amount would finance very little, less than 5 percent of Vietnam's coffee expansion," note Daniele Giovannucci, Panos Varangis, and Bryan Lewin of the World Bank.

Moreover, the impressive growth of Vietnam's coffee sector is not the only contributor to the coffee glut. According to the U.S. Department of Agriculture, Brazil has been producing above 30 million bags a year since 1998-1999—up from 28 and 23 million bags in 1996 and 1997, respectively—and the total number of coffee trees in Brazil has been growing steadily since 1998-1999.

Perhaps the clearest culprit in the oversupply of coffee is the coffee tree itself. It takes at least two years (more for some varieties) for new trees to produce sufficient yields to justify the costs of harvesting. This means that production is slow to react to price changes. "High prices encourage new planting, but the new trees do not have any immediate effect on prices, and there is a tendency towards overplanting," points out Colby College sociologist John M. Talbot in an article in *Studies in Comparative International Development*.

Today's bountiful coffee harvest is to a large extent due to a series of severe frosts that affected Brazil, the world's largest coffee producer, in 1994 and led to rising prices that continued

est consuming country

through the summer of 1997. This encouraged new tree plantings whose harvests are in the market today.

Once coffee trees are in production, they continue to bear coffee "cherries" for over a decade. So, when prices fall, the areas of coffee cultivation don't shrink accordingly. Coffee growers limit inputs like fertilizer and this can lower yields. But they are unlikely to uproot their trees in order to plant something else. Moreover, governments often pay out subsidies to coffee growers during periods of low prices to diminish the social and political consequences of the crisis. The Colombian government, for instance, is guaranteeing a $13 subsidy per bag through the end of September. While this helps tide over the coffee industry, it also helps prolong the low-price period by maintaining the coffee supply at unsustainably high levels.

Trade. (On the other hand, if coffee prices go up dramatically, consumers make their unhappiness known. Rising coffee prices led to Congressional hearings three times in the last century, according to Pendergrast.)

Taken together, the wide swings in coffee production and the relatively stable demand by consumers mean that the commodity price of coffee, like that of other commodities, fluctuates easily by as much as 50 to 150 percent over a few years.

The most visible factor behind the growth in supply is the forceful entry

WHAT'S IN THE CUP?

How is it then that, at a time of historically low prices, American consumers are paying $2 and more for their lattes?

In part, they are paying for a lot more than coffee beans. When Americans buy a prepared coffee drink—be it a cappuccino or one of its humbler relations—coffee is one of the smallest components in the product. One pound of beans makes about 40 cups, according to Don Schoenholt, a well-known coffee enthusiast and owner of Gillies Coffee Company, based in Brooklyn, New York. Even if the beverage is made from great coffee beans—the type that roasters buy for $4 to $5 a pound—the value of the coffee is about a dime per cup. Just "the cup and the lid are about 20 cents... the Equal packet often costs the restaurant as much as the coffee," says Schoenholt. More important, the price of each beverage also has to cover the cost of prime real estate rents, U.S. salaries and benefits for the café employees, research and development, taxes, and marketing expenses, among others.

When it comes to roasted coffee sold for home consumption, the story is slightly different. Coffee accounts for a larger share of the costs of the final product. And the retail prices of these products have gone down accordingly. The average store price for a pound of roast and ground coffee peaked at $4.67 in August of 1997 and then steadily declined to $2.86 in March of 2002, the latest figure available from the Bureau of Labor Statistics. Still, retail prices did not fall as much as international prices in percentage terms: While retail prices fell by 39 percent, international prices saw an 82 percent drop from peak to trough (see chart, page 12).

Here again, coffee is but one of the ingredients. In his mid-size specialty roaster wholesaler (about $5 million in annual sales), Mr. Schoenholt estimates that coffee represents roughly a third of the sale price of his products. Because of this, changes in the price of coffee result in less-than-proportionate changes in the retail prices. A 30 percent drop in the international price of coffee could lead to only a 10 percent decline in the price his company charges.

THE CAFÉ SCENE

Consumers unwittingly bear part of the responsibility for the glut. World coffee consumption has grown slowly over the past decade. The vast majority of coffee produced, about 75 percent, is consumed in developed countries far from the tropics. Undeniably, more Americans are drinking gourmet coffees, which include specialty-grade quality coffees, espresso-based beverages, and iced or cold coffee drinks. From only about 450 gourmet coffee houses in the country in 1991, there were closer to 10,000 of them last year, according to Gary Goldstein of the National Coffee Association (NCA). But this doesn't mean that per-capita coffee consumption is up in this country. In fact, the number of pounds of coffee consumed per person each year has been in a steady decline from its historic peak in 1946, according to Pendergrast. In 1962, for instance, Americans age ten or over were consuming an average of 3.1 cups a day. During the 1990s, per-capita consumption stayed between 1.6 and 1.9 cups. While the growth in specialty coffee consumption has been impressive, it doesn't come with an equivalent growth in total coffee imports that would help absorb some of the surplus produced.

The crux of the problem is that, when it comes to coffee (and other addictive substances), consumers are not very responsive to price changes. For many other goods, changes in retail prices help clear excess production. But, lower prices don't lead to large increases in coffee consumption. By the same token, most studies indicate that coffee drinkers are loath to restrict their coffee intake in response to moderate increases in coffee prices. "A 10 percent increase in price, if taking place in the normal range of prices, leads to a small (2 to 4 percent) decrease in the quantity demanded," points out Harvard professor Robert Bates in *The Political Economy of the World Coffee*

Coffee companies could still be making higher profits from the record-low international prices. Given that consumers don't rush to the store to buy more coffee when retail prices drop, firms have little to gain from lowering prices. Moreover, the coffee market is not a perfectly competitive market with many small companies fighting each other for customers by lowering prices whenever possible. The bulk of coffee sold in the United States is dominated by three major companies: Philip Morris, which through Kraft General Foods owns Maxwell House and other brands; Procter & Gamble, owner of Folgers among others; and Sara Lee, owner of Chock full o'Nuts and Hills Brothers.

But determining whether big companies are seeing increased profits from the drop in coffee prices is extremely difficult. "The largest players in these markets are huge, diversified transnational corporations, and it is almost impossible to sort out how much profit they make on their coffee operations as opposed to their other product lines," writes Colby sociologist Talbot. "Information on costs of production can legally be considered a 'trade secret,' which does not have to be disclosed."

of Vietnam into the market

CUSHIONING THE BLOWS

The current crisis is only the latest, if among the most dramatic, in a rocky history of ups and downs. Because these price swings can be devastating, all players in the market have sought for ways to buffer themselves, with greater or lesser success.

The New York Coffee Exchange, for example, was created in the 1880s after a steep plunge in the price of coffee led to widespread ruin and loss among U.S. coffee importers. As the price collapsed, the American firms were left holding large stocks of coffee that suddenly were worth only a share of what had been paid for them. Today, large coffee importers and roasters can hedge their exposure to price swings by buying coffee futures and options in what is now the Coffee, Sugar, and Cocoa Exchange in New York.

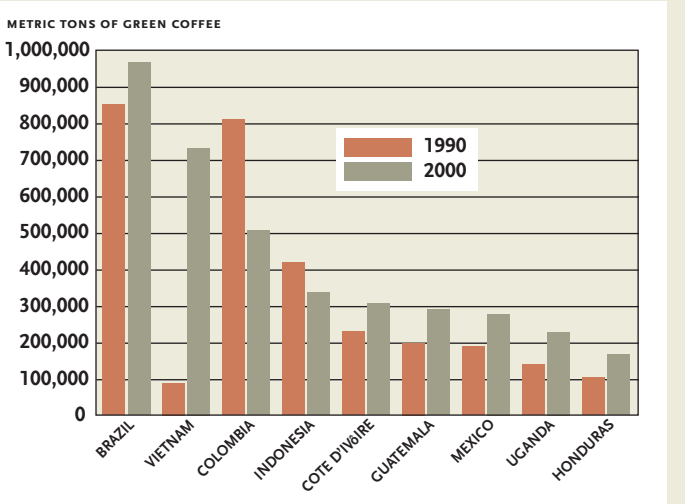
Coffee-producing countries have tried to protect themselves from prices dipping too low by attempting to control supply. In the early twentieth century, for instance, Brazil was by far the dominant coffee producer in the world, accounting for almost 70 percent of production, according to Bates. The Brazilian government began to purchase coffee to limit exports and ensure a high international price. But, such attempts to control the market have always failed, as they require a high degree of international cooperation and the incentives to cheat are always present. When Brazil attempted it at the turn of the century, the high prices encouraged new plantings and the development of the Colombian coffee industry. Not unlike Vietnam's entry today, Colombia's exports rose from 600,000 bags in 1900 to 3.5 million in 1932. And Brazil was unable to control the price on its own.

Arguably, the most successful effort to control supply was through the International Coffee Agreement that was in place from the early to mid 1960s through 1989. Despite smuggling and cheating, the quota system helped to moderate coffee prices from falling too low. To the extent that this effort was successful, it owed its enforcement in large part to the United States, which joined the agreement as a way to prevent poverty and communism from destabilizing its Latin American neighbors. But, as incentives changed, the United States pulled out from the agreement in 1989, and the volatility of coffee prices increased markedly.

Coffee-producing countries have also attempted to cushion growers from the swings of the market more directly. "Before the 1990s, about two-thirds of the coffee-producing countries counted on government-controlled coffee boards that participated in extension services, quotas, price controls, coffee taxation or subsidies, marketing, and even credit," write Varangis and other World Bank economists. But, beginning in the 1980s, international organizations like the World Bank and the International Monetary Fund exerted pressure on developing countries to get the government out of the production and marketing of products. Though this may have helped diminish

top exporters

Brazil, the largest coffee producer in the world, accounted for 17 percent of all green coffee exports over the past decade. Vietnam went from growing less than 2 percent of total exports to 13 percent during the same time.



SOURCE: Food and Agriculture Organization of the United Nations.

inefficiency and corruption, there is widespread agreement that not enough thought was given towards putting safety nets in place. "Despite increased exports, many producers, who are often among the poorest, are left in a position of greater exposure to risk, particularly to price risk," adds Varangis.

Although farmers in developed countries, such as the United States, are also subject to the vicissitudes of weather and other forces, they have access to generous government subsidies and market-based tools that help buffer them from the blows. In many cases, the industry is dominated by corporate behemoths that, by virtue of their size, have access to ample sources of credit and to market products that have been developed to manage such risks. Additionally, small farmers tend to have diversified sources of income, with family members working outside the farm (often out of necessity) bringing in a steady salary independent of the crop's fortunes. By contrast, the failure and the dismantlement of past efforts by developing countries to cushion coffee growers from market risks, have led to the precarious situation they find themselves in today.

Interestingly, one of the newest strategies to protect developing countries' farmers is coming directly from consumers in industrialized countries. In response to growing concerns over the fortunes of those who make the products they buy, some consumers are trying to foster equitable labor practices and better standards of living through the purchases they make. The "Fair Trade" movement attempts to eliminate middlemen in the chain and guarantee a higher price to growers. As a widely traded commodity with connections to many developing countries, coffee was a natural fit and one of the first items to be targeted. Today, American consumers can buy Fair Trade certified coffee, which is grown by small owners organized into farmer cooperatives that meet the requirements and pass the inspection of the international Fair Trade labeling group, TransFair USA. Fair Trade coffee guarantees farmers a minimum price of $1.26 a pound. This price was arrived at by looking at the price pegged by the defunct International Coffee Agreement, according to Rob Everts, codirector of Equal Exchange, a coffee importer and roaster based in Canton, Massachusetts, which deals exclusively in Fair Trade coffee.

By guaranteeing a minimum price, Fair Trade makes planning easier and removes a share of the producer's downside risk (not necessarily all of it because often farmers are only able to sell part of their harvest as Fair Trade). But it cannot hope to solve the problem for all growers. Fair Trade coffee does not protect the laborers who work on the larger plantations. And, so far, there is much more coffee that qualifies as Fair Trade coffee than there are buyers willing to pay for it. Fair Trade coffee is less than 1 percent of the market in the United States and in Europe, according to Pendergrast. So far, it has been the high-end coffee shops and some certified roasters that have proven venues for the product, not the big roasters that account for the bulk of the trade.

If the Fair Trade movement grew large enough to significantly involve the large companies and cover even the daylaborers, the movement would have to find ways to limit the growth of coffee cultivation, which is encouraged by the guaranteed high prices. Otherwise, its very success could bring its downfall by, once again, leading to an oversupply of the product.

Even with the rise of specialty coffee, U.S. per-capita consumption has be

UNCERTAIN HORIZON

There are no easy solutions to the problems of low coffee prices, and no solutions that will take care of everyone. The long his-

coffee dependence

Some of the world's smallest coffee producers are heavily dependent on revenues from coffee exports. In contrast, semiconductors, the largest export earner for the United States, only accounted for 5.6 percent of total exports in 2000.

	VALUE OF GREEN AND ROASTED COFFEE EXPORTS (US$1,000)	COFFEE AS % OF TOTAL EXPORTS	EXPORTS AS % OF GDP
Burundi	30,951	56	8
Uganda	308,721	52†	12†
Rwanda	17,402	27*	6*
Ethiopia	255,336	26	16**
Honduras	410,039	16	42
Nicaragua	134,826	15	37
Guatemala	575,357	15	20
Ecuador	24,349	11	42
Papua New Guinea	164,305	10*	47*
El Salvador	340,342	9	28

*1999 data **1998 data †1996 data

SOURCES: Food and Agriculture Organization of the United Nations, International Monetary Fund.

en in steady decline since 1948

tory of price swings serves as a stark reminder of the difficulties in finding lasting solutions to the instability of coffee prices and the income of the farmers who grow and depend on it. And there is reason to think that the current trough in coffee prices may be among the longer lasting.

Industry insiders and World Bank experts agree that the coffee industry is undergoing fundamental changes that will prevent prices from rebounding to previous heights anytime soon. Vietnam's increased role in coffee production has implications that go beyond the cultivation-and-price roller coaster. It is a move that signifies a shift towards growing cheaper coffee in a lower-cost region—not unlike the way that American manufacturing moved first from the Northeast to the South, and then abroad.

"The costs of production range from country to country, perhaps from 60 to 90 cents for a pound of the arabica variety," says Equal Exchange's Rob Everts. But Vietnam faces costs well below this range. Labor is cheaper in Vietnam and, moreover, the bulk of the country's coffee production is comprised of the robusta variety, which is significantly less expensive to grow. As its name indicates, robusta tends to be more resistant both to hot weather and diseases—requiring fewer pesticides. It can be grown at lower elevations, with flatter terrain, and the trees have higher yields.

Beyond the lower-cost issue, the expansion of robusta in the market has the effect of dragging down the prices of most other varieties of coffee. "Robusta beans are noteworthy for their harsh, dirty flavor and abundant caffeine—twice as much caffeine, in fact, as is found in arabica beans," write Kevin Knox and Julie Sheldon Huffaker, authors of *Coffee Basics*. Their inferior taste means robusta beans sell well below the price commanded by standard arabicas. But roasters are able to substitute the cheaper beans into their blends—up to a certain point—before consumers notice or react to the difference in quality. According to World Bank economist Panos Varangis, the share of the more expensive mild arabicas in blends has fallen from 50 percent in 1989 to about 35 percent in 2001. At the same time, robustas and (cheaper) natural arabicas have seen their shares increase. If this change persists, coffee prices could remain low, at least for the near future.

Those hardest hit are Latin American countries with relatively high production costs. These countries can try to find ways to lower their costs or find niche markets that command price premiums, such as organic or environmentally friendly shade-grown coffees that provide needed habitats to migratory birds. But such options will not help everyone. Many growers will ultimately have to move to other more lucrative products.

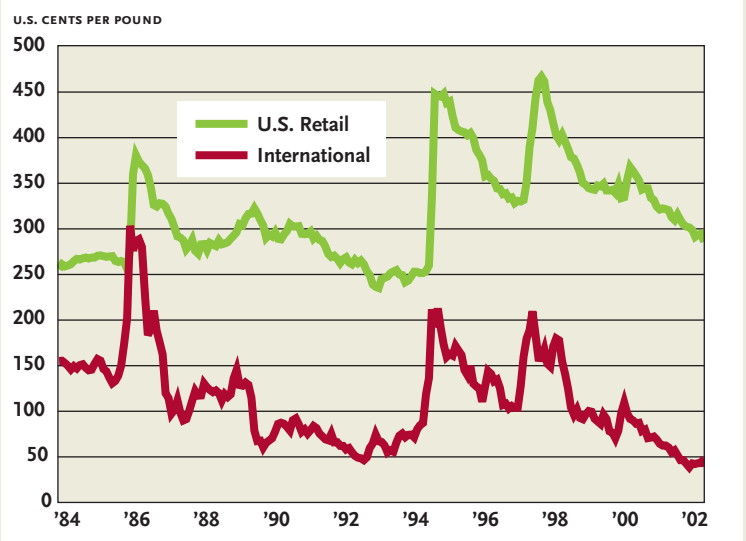
In the current price slump, enough farmers will eventually be driven out of business that the price of coffee will likely rise again. That means another potential shortage is looming in the future, particularly for the higher-quality coffees that are more costly to produce. And this shortage may drive prices high enough to encourage overproduction once again.

It is not clear whether, or perhaps more aptly, when, this damaging cycle will repeat itself. What is clear is that new and better solutions are needed to help diminish the human price, a price that is now being paid mostly by the most vulnerable workers in already poor countries. ❊

The coffee that goes into a cup costs only about a dime, even for high-qua

the price roller coaster

The supermarket-aisle price of roasted coffee goes up and down with the international price. But because retail prices are higher overall, changes in the international price are much larger in percentage terms.



SOURCES: Bureau of Labor Statistics, International Coffee Organization.


lity beans

Preserving our past >>

NUBAR ALEXANIAN

>WHO SHOULD BEAR THE COST OF HISTORY?

TONY BACEWICZ/THE HARTFORD COURANT

The dispute over CIGNA's Wilde building draws attention to the tension between saving our past and making room for our future.

This is not the typical historic preservation controversy. After all, it's about an office park. Employee benefits giant CIGNA's former headquarters in Bloomfield, Connecticut, is a standard-bearer of the International Style of modern architecture. And as a progenitor of the postwar corporate move to the suburbs, it is also a piece of history. But the property—and particularly the signature Wilde building, completed in 1957—cannot be mistaken for anything other than the corporate campus

BY CARRIE CONAWAY


NUBAR ALEXANIAN

>>>THE WILDE'S BUILDING, CAMPUS, AND INTERIORS WERE DESIGNED TOGETHER, WITH FORM FOLLOWING FUNCTION


EZRA STOLLER ©ESTO

that it is. Though both beautiful and historic, it is not a tourist destination.

That's why CIGNA was surprised to learn how strongly historic preservationists wanted to save it. CIGNA's executives knew that both the Wilde building and the smaller Emhart building also located on the property held historic and architectural significance. But they felt the 650-acre campus was too large for their current needs, and the buildings were so outdated and expensive to run that they were hampering their employees' productivity. So in 1997, they began work on a proposal to redevelop the property over the next decade. The Emhart building would be torn down to make space for a golf course and single-family housing. The master plan also called for a new hotel and conference center to stand on the exact location of the Wilde building.

Architects and preservationists were aghast. Though most felt the entire property was of great importance, the thought of losing the Wilde was particularly galling since it is considered one of the best-executed examples of modernist corporate architecture in this country. "It is an extraordinarily powerful building in a landscape that was carefully considered," says Robert Stern, dean of the Yale School of Architecture. "This is not every building; this is a landmark of its time." Bolstered by its listing as one of National Trust for Historic Preservation's eleven most endangered historic properties in 2001, efforts began in earnest to save the entire property; still, its future remains uncertain.

Obviously, we can't save everything. Hanging on to every potentially significant item means turning scarce space into a repository for a constantly increasing volume of junk. Yet without some markers from our past, we develop a kind of amnesia, losing our sense of personal history and place in the world. Every building saved is that much more culture and history available for the next generation, but also that much less room for that generation's own culture to thrive. The conclusion—saving some things but not all—is uncontroversial. But as the CIGNA case demonstrates, it's never easy to know where to draw the line or who should pay the cost.

A THOROUGHLY MODERN CAMPUS

When CIGNA (then Connecticut General) built its flagship headquarters in 1957, it was a watershed moment in the history of modern architecture. While the campus itself was significant for its elegant design and spacious feel, and while the Emhart building (added a decade later) was also an excellent example of corporate modernism, the true gem of the property was the Wilde building, named for Connecticut General's then-president, Frazar B. Wilde. It was hailed as one of the "ten buildings in America's future" by the American Institute of Architects. It also received a gold medal from the Architectural League of New York in 1960 (the other that year was awarded to Mies van der Rohe's Seagram Building), along with numerous other national awards. Designed by Gordon Bunschaft, an architect at the world-renowned Skidmore, Owings, and Merrill architectural firm in New York City, the Wilde building exemplified the modernist ideal of form following function. Its profile—only three stories high in most places and over 1,000 feet long—perfectly matched the needs of an insurance company in the 1950s. The long stretches of desks and offices were critical to keeping the flow of paper moving efficiently, much as long assembly lines on a single floor keep manufacturing plants producing at top speed. The employees worked on a strict time schedule, complete with bells for lunch periods, so wide hallways and high ceilings were incorporated to move large numbers of workers at once without a claustrophobic feel. None of the clocks in the building were visible to people at work; Frazar Wilde felt employees worked more productively if they could not constantly watch the time, so the clocks were concealed behind the water fountains instead.

In an interview just after the building was completed, Wilde said, "We wanted the most efficient building that could be built. If it turned out to look well, we'd be pleased." As it happened, the building was a success on both counts. The 12-foot-wide blue-green windows, the thin stainless steel mullions dividing the panes, and the expansive footprint all lend a sense of openness and transparency to the building despite its great size (originally 586,000 square feet, later expanded by about one-third to 827,000 square feet). Eschewing ornamental detail, it instead achieves its grace through linearity and light. The expanse of windows brings plenty of natural light to the building's inhabitants. For those without exterior offices, six sculpted interior courtyards guarantee that no employee is more than 35 feet from

The bright natural light throughout the building accentuated the original interior design's bold colors and open floor plan.

a window, and the employee cafeteria, a one-story glass-walled unit cantilevered over a reflecting pool, provides a 270-degree view of the park-like grounds. The architects let the building and landscape speak for themselves; few embellishments or even curves can be found in the building's design, save the circular driveways to the entrances. Even the few artistic elements on the property, such as a granite sculpture symbolizing the family by Japanese sculptor Isamu Noguchi, are simple and geometric in appearance.

This sparse look is, purposefully, also reflected in the interior design, done by Florence Knoll of Knoll Associates. "Buildings like Connecticut General were the first where the architecture and the interiors were literally one, designed as a complete whole," says Christine Gorby, an expert on Knoll and assistant professor of architecture at the Pennsylvania State University. Photos of the original interior reveal a modern aesthetic, with an open floor plan, laminate walls, and extensive use of primary colors and nubby textures to complement the brightness of the natural light flooding the building. Every interior element, from office walls to furniture, was designed in six-foot modular units to enhance the flexibility of the floor layout. Indeed, the modular office walls Knoll designed for the building, the first of their kind, were the forerunner of today's cubicles.

While its design was groundbreaking, the Wilde building is equally significant for its social impact. In the late 1940s, it became clear that the Connecticut General's current space in downtown Hartford was no longer adequate. But instead of increasing its vertical space downtown, Frazar Wilde proposed to move the company to suburban Bloomfield, Connecticut, four miles away from downtown. "Other companies had moved to the suburbs before Connecticut General, but the way they did it was totally original," says Yale's Stern. The sensible horizontal design of the new building was unheard of in the insurance industry. And the amenities included to entice workers away from the conveniences of downtown were astonishing by today's standards. The new building included a 400-seat au-

EZRA STOLLER ©ESTO

>>>AS ONE OF THE NATION'S EARLIEST OFFICE PARKS, THE CIGNA CAMPUS FORESHADOWED THE POSTWAR EXODUS FROM CITY CENTERS TO SUBURBAN AREAS

ditorium for community events, 12 bowling lanes, a Lord & Taylor department store, barber and beauty shops, a 14-bed women's ward ("for resting"), a library, a club store, tennis courts, and two softball diamonds.

The success of suburban corporations like Connecticut General inspired companies across the country to move their headquarters out of downtown districts and into the countryside. Office parks and tract homes proliferated in suburban areas, and the economic decline of the inner cities began in earnest as jobs moved away from easy access by public transportation. Fifty years later, we are still feeling the economic and social ramifications of this change. The drive from Bloomfield to Hartford along U.S. Route 44 today serves as testimony to its less fortunate consequences; what had once been a vibrant, bustling part of Hartford is now lined with run-down used car lots and fast-food restaurants. For better or for worse, the postwar shift of economic activity to the suburbs is a critical element of the social history of the twentieth century.

MODERNISM'S DISCONTENTS

Not everyone agrees, though, that the property is worth saving. Problems in the Wilde building's design were obvious from the beginning. For instance, the entire building is made of single-pane glass. While the glass is infused with iron filaments to reduce solar load and glare, it is not nearly as energy-efficient as today's building materials. Furthermore, the two long sides of the building face north and south, respectively. Floor-to-ceiling glass throughout the building means that the north side is chilly while the south side bears the brunt of the sun. To make the inside temperature comfortable, the 1950s-era heating and air conditioning systems have to be run simultaneously 365 days a year. As a result, the building's operating cost is nearly 75 percent higher than that of a typical modern office structure.

To the designers' credit, the building plans anticipated some growth and changes in technology, but no one could have predicted the company's technological needs 50 years in the future. The original building design left some room in the subflooring

MARY KOCOL

FOREVER OURS?

Since 1966, the National Park Service has been cataloguing America's most significant historic properties in its National Register of Historic Places, which now contains over 74,000 listings. Anyone may propose that a property, building, or historic district be listed on the National Register. Properties qualify if they are associated with events or people of major importance in American history, if they are especially good examples of a particular type or method of construction or of an architectural master, or if they contain important artifacts from prehistory or history. Cemeteries, birthplaces, and religious sites are usually excluded, as are properties less than 50 years old or moved from their original location—though exceptions are occasionally made. Furthermore, no property is placed on the National Register without the owners' consent.

Most people think that listing a property on the National Register of Historic Places means it is forever protected against demolition and decay. But according to historic preservation consultant Donovan Rypkema, "owners can alter the property, tear it down, even paint it bright blue if they want to." National Register membership is primarily honorary and does not take away any property rights from owners, so long as they do not use federal funds to change or demolish the property. At the same time, properties on the National Register are eligible for a 20 percent tax credit for historically accurate rehabilitation projects, and the National Park Service offers some grants and technical support to historic property owners.

States also maintain their own registers of historic places. Connecticut's state register, for instance, was created in 1975 and now lists over 50,000 properties. A listing on the state register is mainly symbolic, though a few small tax credits and grants are available for rehabilitation projects. But Connecticut has an interesting wrinkle in its historic preservation laws. Unlike any other state, if a Connecticut property is on the National Register and is threatened with demolition, any citizen can seek an injunction against the owner to prevent the "unreasonable destruction" of a historic property. This law does not apply in the CIGNA case, however, since the property is not on the National Register (although it is eligible for inclusion due to an exemption from the 50-year rule, CIGNA has opposed its nomination). Even if it were, CIGNA would still be off the hook from the state regulations; it obtained an exemption from the law for the property in a special state legislative session in 2001.

The Wilde's windows are infused with iron filaments to reduce solar load and glare, but the building is still much more expensive to operate than newer structures.

for additional wiring, for example, but not nearly enough to serve networked computers and Internet access. The subfloor space filled quickly, leaving no choice but to install corrugated ductwork onto the ceiling to manage the wires.

Other problems arose as social values changed. The shift of corporate activity to the suburbs, which Connecticut General had foreshadowed, ultimately led employees themselves to move to suburban areas. As dry cleaners, grocery stores, and shopping centers sprang up to support people living outside the cities, suburban corporations no longer needed to provide these services. The 41 percent of space in the Wilde building devoted to such uses, once critical to retaining workers, now seems extravagant; contemporary office buildings typically use all but 10 to 15 percent of their space for actual offices.

All these problems could likely be surmounted with some creative rethinking about the building's design; in fact, a quality restoration of the building would likely cost no more than new construction. But what really prohibits CIGNA from continuing to use the building is the very thing that made it ingenious in its time—its manufacturing-model floor plan. While critical for efficiency in the 1950s, it is no longer important to minimize travel between multiple levels of the building since computer networking drastically reduces the amount of paper moved around. It is far more economical for employees to walk a few steps to a central elevator and ride to the appropriate floor, which is why the typical modern office building has a footprint one-tenth that of the Wilde. Nor can this problem be solved by dividing the building into smaller operating units. "The maximum efficiencies of this building were designed around the concept of not breaking it up," says Tony Paticchio, CIGNA's project counsel. "Once you start carving it up, it stops functioning in an efficient manner."

These inherent inefficiencies, coupled with the practicalities of moving thousands of employees into and out of the buildings during renovation, meant that when CIGNA was evaluating its property and assets in 1997, its managers were more than willing to consider redeveloping the entire campus—the Wilde building included. They spent the next three years developing a master plan for the property, based on analyses of what types of services and industry the greater Hartford economy could sustain. Ultimately they proposed to convert the majority of the property into a public 18-hole Arnold Palmer golf course, filling in the remaining areas with single-family housing, luxury apartments, and new office space for CIGNA's and others' use. Under the master plan, CIGNA's presence on the property would shrink to 40 or 50 acres (less than one-tenth its current space) and would be concentrated in the southwest corner of the property. The site currently occupied by the Wilde building would be used for a new hotel and conference center. The Wilde building would be razed.

Long rows of desks on only three floors made processing claims efficient; less paper had to be moved up and down stairs.

THE SOCIAL VALUE OF HISTORY

Like most property owners, CIGNA's first concern is the cost to the company—what economists call the private cost—of preserving the building versus redeveloping the property. This factor is particularly potent in this case since it is a business property, not a private home or a public building. "The top priority for us is the need to compete in a low-margin, service-intensive business," says Ken Ferraro, spokesperson for CIGNA. "It would be irresponsible of us to take the limited view that saving the building should take precedence over the needs of our business, our employees, our clients, our shareholders, and the Bloomfield community." From CIGNA's perspective, maintaining the property is simply too costly to be worthwhile.

Demolishing historic buildings often negatively affects nearby communities by decreasing tax revenues and thwarting the potential for heritage tourism. But in this case, CIGNA's acting on its private interests may actually benefit the city of Bloomfield as well. Bloomfield, today a town of 20,000 residents, is still rebuilding from recent hard times as a result of the economic decline in the Hartford region more generally. CIGNA is by far Bloomfield's largest taxpayer, at $5 million per year. If the redevelopment plan proceeds as proposed, the new homes and businesses on the property would net the city an estimated additional $2.2 million in revenues each year—enough to cover the projected increases in the city's budget without raising taxes—and would make it less vulnerable to the fortunes of a single employer. City officials favor the plan.

Considering only the costs to CIGNA and to the city of Bloomfield of keeping the building, though, excludes an important perspective on the debate—that of society at large. We all benefit from preserving beautiful and historic buildings, and we are all hurt when they are lost to demolition or decay. Yet the cost to society of losing a building is rarely incorporated into property owners' decisions. Part of the reason is that social value is nebulous and hard to quantify; after all, who can claim to put an accurate dollar figure on the value of history? But even if we knew exactly how much the Wilde building was worth to society, only a fraction of its social value would ever return to CIGNA through the market. Some would be capitalized into property values, as homes in nationally designated historic districts often appreciate faster than similar nonhistoric homes. But since business property values derive more from functionality than aesthetics, the portion of the Wilde's value due to its historic significance is likely to be small. An additional portion of social value could be recaptured through admission fees if the building were converted into a museum, but the Wilde is an improbable and oversized choice for a tourist destination, far removed from other regional attractions, and thus unlikely to raise much revenue.

Most significant, though, the market offers no mechanism to capture revenues from the Bloomfield residents who appreciate the building's beauty or the community services it provides, from the architecture buffs who value knowing that the Wilde exists but will never spend money to travel there, from the heritage tourists who wish to preserve the option to visit the Wilde building in the future, or from the future generations who might want to see the building themselves. Without those dollars in its wallet, there is no way for CIGNA to incorporate the social

EZRA STOLLER © ESTO

>>>HOW CAN WE ENCOURAGE PROPERTY OWNERS TO MAKE SENSIBLE DECISIONS FOR SOCIETY AS WELL AS THEMSELVES?

RICK HARTFORD/THE HARTFORD COURANT

cost of demolition into its decision. Instead, it will act on its private interests, an approach unlikely to yield the best decision from society's point of view.

THE COURT OF PUBLIC OPINION

It is notoriously difficult to find ways to encourage property owners to consider the social costs of their development plans without infringing on their property rights. Even properties listed on the National Register of Historic Places are not protected from adaptation or demolition (see sidebar). Historic properties not on national or state registers have no protection at all. Instead, the federal government and most states use a carrot rather than a stick, offering tax credits for certified restorations of Register-listed properties. While these credits are beneficial for those who wish to restore their properties, there is no incentive for less civic-minded owners, or those who still can't afford the cost of renovation, to follow suit. Private interests are still pursued at the expense of society's.

One strategy for creating a market for the social value of history is to increase the number of historic properties owned by public and nonprofit organizations. The Nature Conservancy, for instance, promotes natural resource preservation by purchasing at-risk properties and then opening them to public use. Likewise, in some instances local historic preservation societies will scrape together funds and purchase an endangered historic resource rather than see it razed or irrevocably altered. The problem with this approach, according to historic preservation consultant Donovan Rypkema, is that "owning buildings is very expensive. It costs you next to nothing to hold vacant ground, but if you own an improved property, you have liability, taxes, insurance, tenants—all kinds of complications." As a result, there is no national historic preservation organization following the Nature Conservancy model that could take up the charge to save the Wilde, and the market value of the Wilde building is far beyond the range of any local preservation group's budget.

If CIGNA itself wanted to permanently preserve the Wilde, it could file a legal document called a preservation easement ceding the right to alter or develop the property not only for themselves, but also for all future owners of the property. It would then be eligible for a tax deduction in the amount of the loss of value incurred by the restrictions on the property's development rights. This strategy is particularly successful for people who own important pieces of open space, such as farms or river banks, and who want to maintain public access to them in perpetuity. CIGNA's commitment to its redevelopment plan and its desire to divest itself from ownership of the property, however, mean it is unlikely to pursue this approach.

While neither of these approaches is likely viable in this case, the social value of the Wilde may ultimately be given due consideration in the court of public opinion. The building has been called "the Mona Lisa of modern architecture," "an internationally recognized landmark." Its potential demolition has attracted the attention not only of local community members, but also of prominent architects, historians, and preservationists. The Yale School of Architecture designed an exhibit on corporate modernism featuring the Wilde. Numerous press articles and public forums in Hartford and beyond have highlighted the controversy, many questioning CIGNA's decision to raze the building. Unlike public ownership or preservation easements, community pressure doesn't literally put the revenues from social value into CIGNA's pockets. But it does increase the social cost of choosing to knock down the building, since the eyes of the public are now watching.

If CIGNA wants to accommodate the public interest while still pursuing its redevelopment plan, what are its options? As in many historic preservation controversies, the compromise may lie in adaptive reuse—preserving the original architecture while adapting it to the needs of the twenty-first century. One current proposal is to tear down only the newer part of the building. This would leave the original 586,000-square-foot edifice to serve as the hotel and conference center slated for the site. The remaining portion of the building would still be twice as large as the proposed hotel, but the extra room could be converted into office space.

To truly preserve the social value of the building, though, enough of what makes it architecturally and historically significant must be retained. Otherwise it will not serve its intention as a marker of modernism's aesthetic, vision, and social consequences. The trick will be finding a developer willing to work with the building as is rather than starting with empty land. "A hotel corporation would like their design put in place. An office user would like perfectly laid-out office space," says Bob Fair, project manager for CIGNA. "Ultimately it will come down to the realities of the market and the flexibility of the developer." Fortunately, there's still time to negotiate. The wrecking ball won't arrive until sometime in 2005. ❊

BY DAVID H. AUTOR, FRANK LEVY, AND RICHARD J. MURNANE ILLUSTRATIONS BY ANDERS WENNGREN

Upstairs Downstairs

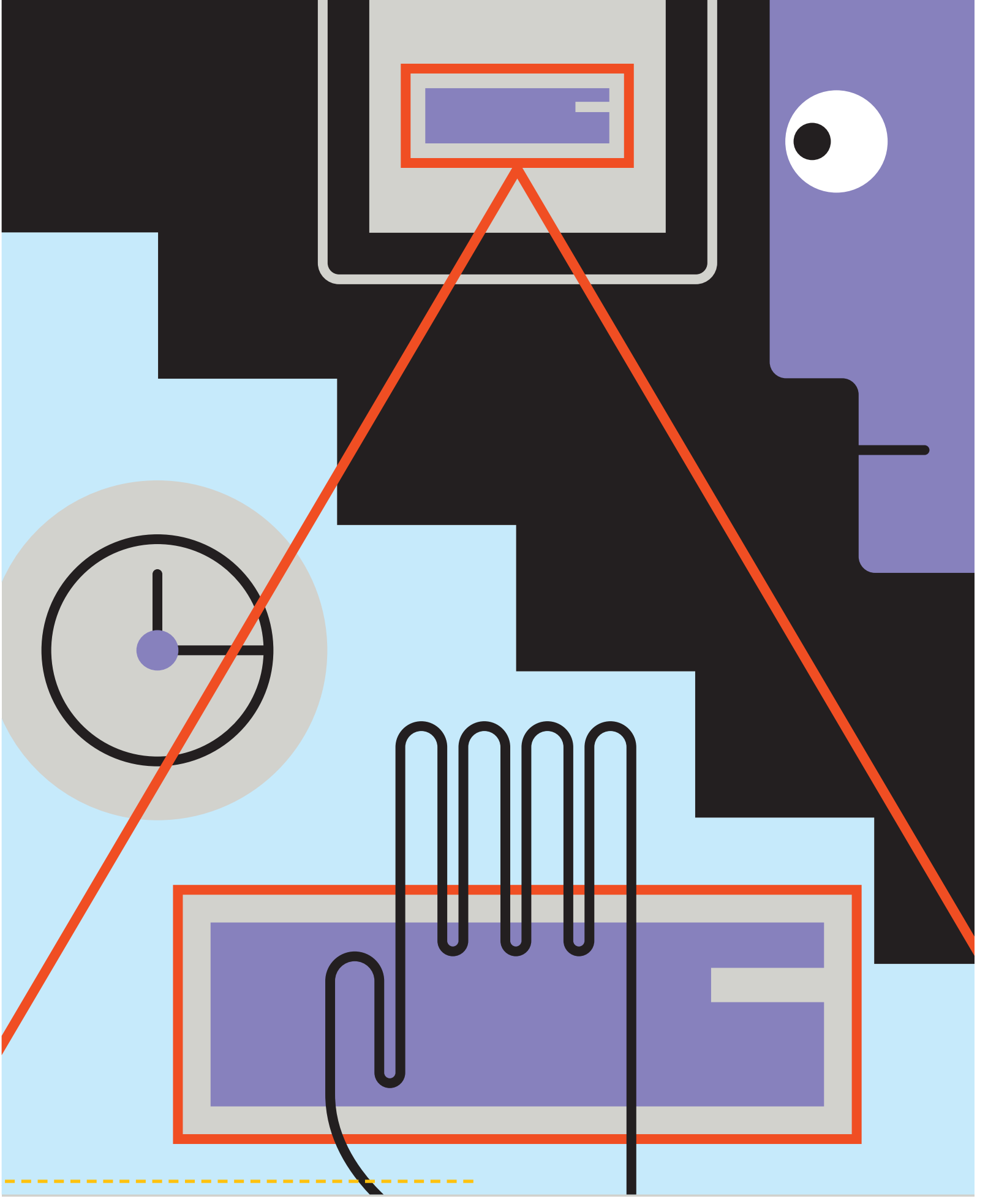
How Introducing Computer Technology Changed Skills and Pay on Two Floors of Cabot Bank

Cabot Bank* was one of the 20 biggest banks in the United States in 1998. It had both large retail and commercial banking operations, with branches in several states and many countries around the world. Retail business had more than doubled in size over the past decade, mostly through the acquisition of smaller banks. Every day, 2.8 million checks were deposited in its branches and automatic teller machines.

But industry consolidation and other factors were placing Cabot and its competitors under increasing pressure to improve check-processing efficiency. The number of checks passing through Cabot's doors had increased dramatically, up from 1 million in 1988. Yet, Federal Reserve regulations mandated that customers have access to deposits within two days for checks drawn on local banks and that the actual paper check be returned to the bank on which it was drawn. Speed was also important in minimizing the cost of "float" or the period of time after the deposit was credited to the customer but before Cabot collected the funds. And deregulation in the banking industry had dramatically intensified the competitive pressure to reduce costs and provide customers with new and better services.

Cabot responded by introducing two new computer technologies: check imaging (photographing checks and storing the images on computer) and optical recognition software (scanning and capturing the dollar amounts on checks and deposit slips). As one of the first U.S. banks to adopt check imaging, this immediately put Cabot in the forefront of the industry.

*not its real name



But introducing the new technologies would do more than increase productivity and reduce costs; it would also change the tasks performed by Cabot's workers and the way those tasks were organized into individual jobs—with great potential impact on employees. Would workers performing processing require greater skills and receive higher wages after the reorganization? Or would the job require fewer skills and lead to a decline in pay?

As computers have gradually become an integral part of almost every workplace, such questions have taken on a new significance—significance that goes beyond the workers in Cabot Bank or even in the banking industry. A substantial body of research finds that the rising use of computers in the modern economy is associated with an increased relative demand for educated workers, both in the United States and in other industrialized countries. Consequently, computer technology has been identified as one factor responsible for the sharp rise in wages paid to college-educated workers compared to those with less education and, therefore, an important reason for the marked increase in income inequality that has occurred over the past 25 years.

Exactly how and why does the introduction of computers result in these outcomes? Is it simply that machines substitute for less-skilled workers and reduce the demand for their labor? Or is the explanation more subtle? And perhaps just as important, is the chain of events inevitable? Or do managers have the latitude to influence the design of jobs, and consequently skill requirements and wages?

To begin to answer these questions, we followed what happened in two departments of Cabot Bank that were reorganized when the new computer imaging technology was introduced—downstairs in deposit processing and upstairs in exceptions processing. We found that computer-based technology did indeed create strong pressure to substitute machines for people in certain tasks—those that can be described by procedural or "rules-based" logic. However, this typically left many tasks to be performed by people. In those instances, we found that Cabot's management played a key role—at least in the short run—in determining how the tasks were reorganized into jobs, with important implications for skill requirements and wages.

SKILLS AND COMPUTERS

Why do we see a correlation between computers and an increased demand for high-skilled labor? The simplest argument, often seen in the popular press, is that computers substitute for low-skilled labor in carrying out tasks. In the economics literature, researchers have argued that introducing computers increases the productivity of highly educated workers more than it does the productivity of workers with less education. Both explanations imply an increase in demand for highly skilled workers relative to those with fewer skills.

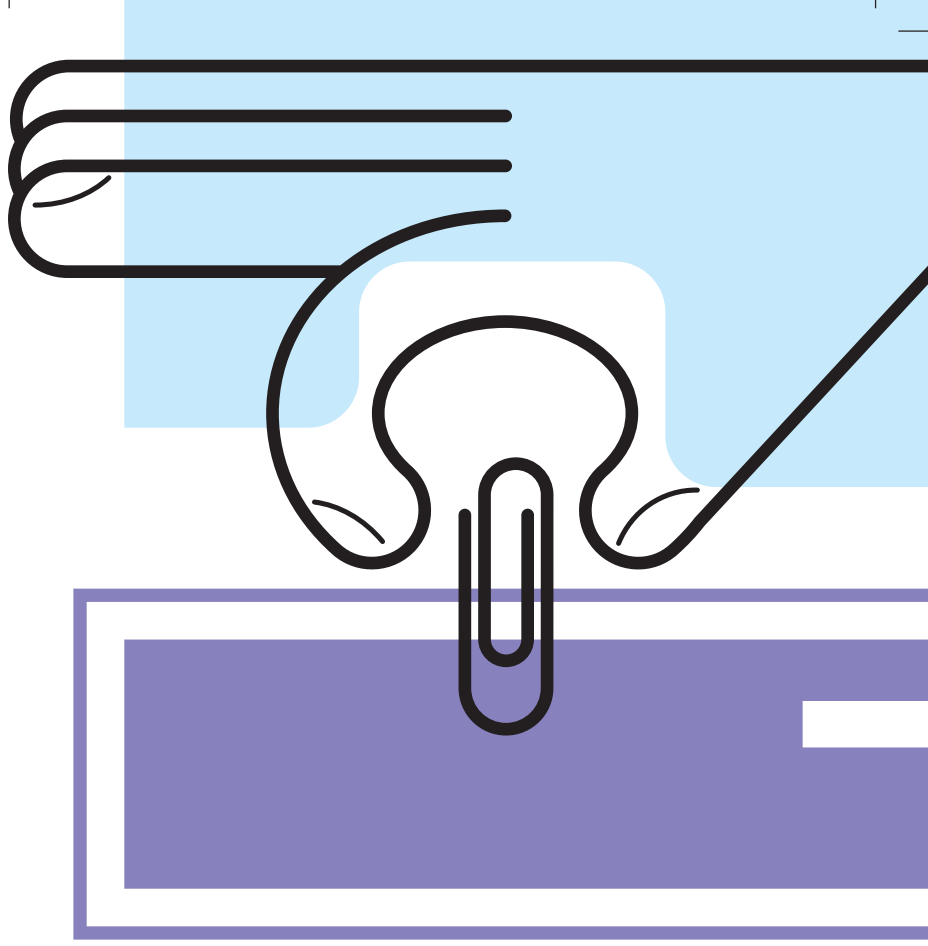
But other researchers emphasize that the connection between computers and skill is more complicated. They point out, for example, that "skill" is a multifaceted concept that is not reducible to a single dimension. Which task is more skilled: conducting biological research or managing a large organization? Both are complex and difficult, each in very different ways. One thing they *do* have in common is that they require a great deal of problem solving. Yet, other activities—walking across a crowded room or carrying on a conversation with many voices in the background—are also highly skilled tasks, even though people master them with little conscious thought. As the late scientist and philosopher Michael Polanyi observed, "We do not know how to do many of the things we do."

How does this link up with what computers do? In most commercial applications, computers perform tasks that can be fully described as a series of logical programming commands ("if-then-do") that specify what actions the machine will perform and in what sequence at each contingency. (One notable exception is the self-organizing neural networks sometimes used in data mining.) Since if-then-do tasks include many relatively simple back office activities, such as recording and managing information, this is consistent with the empirical evidence that adopting computers is associated with a decline in the percentage of high school graduates in an organization's workforce.

At the same time, computer scientists have been relatively unsuccessful to date at programming computers to perform many activities that are unskilled by the definition that most humans can do them with little or no training. Commonplace manual tasks, such as mopping a floor, maneuvering a vehicle through traffic, or removing staples from checks are examples. These tasks have proven surprisingly difficult to automate because they require optical recognition and adaptive fine motor control that are still poorly understood and cannot (yet) be described by a computer program. Like walking across a crowded room, these are also among the many activities that fit Polanyi's observation. Although these tasks do not require workers with a formal education, a switch to computer-driven machinery for these jobs is not likely any time soon.

In addition, computers can typically only address known problems; contingencies unanticipated by the programmer

began acquiring new banks



will result in a dead-end. So computers cannot yet carry out many of the problem-solving tasks that managers and professionals tackle routinely. However, computers may increase a skilled person's productivity in accomplishing these tasks by speeding the search and retrieval of information. For example, bibliographic searches may increase the quality and efficiency of legal research, timely market information may improve the efficiency of managerial decision making, and richer customer demographic information may increase the productivity of salespeople.

Rapid advances in computer technology—and accompanying rapid price declines—create strong pressures to computerize tasks that can be described as a sequence of if-then-do tasks. At the same time, the impact of computers on the organization of work is not deterministic. Typically, there is more than one way to organize into jobs the tasks that are not computerized. In these cases, managerial decisions can play a significant role, at least in the short run, in determining the organization of work and hence the skill requirements of jobs.

CHECK PROCESSING AT CABOT

Fifty years ago, banks did all the sorting, balancing, posting, and handling of deposits and exceptions by hand with the aid of mechanical adding machines. The first major wave of technological change came with Bank of America's introduction of Magnetic Ink Character Recognition (MICR) in the early 1950s. Using MICR, a bank could give customers checks and deposit slips with bank and account numbers imprinted in machine-readable magnetic ink. Companies including General Electric, Remington, and IBM developed reader-sorter machines that could read the information and sort checks according to the banks on which they were drawn. This reading/sorting was an early example of computers substituting for human labor.

Until the mid 1990s, the Deposit Processing Department at Cabot centered on the job of the proof machine operator. The Cabot processing center would receive a package of several hundred checks from a customer, the local supermarket for example, including a deposit slip and adding machine tape. The proof machine operator would remove the paper clips and staples from the checks, make sure that each check faced in the same direction, key in check amounts, and, finally, add the checks and verify that the sum matched the total on the deposit slip. If the totals did not match, she would examine the adding machine tape and the encoded check amounts to find and correct errors such as a keying error by the proof machine operator, a listing error by the supermarket employee, or a check lost in transit. Then, the checks were sent to a machine to be sorted them by account number.

Checks requiring individual attention were sent upstairs to the Exceptions Processing Department. These included checks written on closed accounts, checks for amounts greater than the account balances, checks with stop payments on them, checks written for amounts large enough to require signature verification, and fraudulent checks. About 3 percent of checks fell into one of these categories. In contrast to deposit processing, exceptions processing was organized into a number of narrowly defined jobs. For example, if the employee who verified signatures on large checks found a discrepancy, that person filed a paper form that led to further action by another worker with greater decision-making authority. A check could pass through three or four levels before reaching someone empowered to make a decision. Another group of workers processed stop-payment orders, and still another group handled checks returned for insufficient funds. In each case, a significant portion of the day was spent shuffling paper to find the right checks in boxes of newly delivered items, or to move checks from one group to another. Since all work was done under deadline, this created substantial employee frustration.

As in deposit processing, female high-school graduates held most of the jobs in the exceptions department. Turnover was high—30 percent a year—tolerable only because the skills required were minimal and could be learned quickly. Long-term employees developed expertise in one task, but had little knowledge of the work outside their immediate

Imaging technology made it cheaper to divide the rout

area. As one manager commented, "People checked their brains at the door."

As Cabot began acquiring new banks and the daily volume of checks rose sharply, the cumbersome workflow created even greater delays and poor service. For example, customers who were short of cash would sometimes buy time by writing multiple checks and then issuing multiple stop-payment requests. Depending on the timing, each check might trigger an overdraft exception and a stop-payment exception. If a check were large enough, it also would trigger a signature verification exception. Each of the three clerks involved would have only a partial picture, and each would have to locate the same paper check to complete the processing. In the end, the customer might be (incorrectly) charged with both a stop-payment fee and an overdraft fee. If the customer called to resolve the situation, there was no single person with all the relevant information who could handle the problem.

In an effort to surmount these shortcomings, Cabot Bank introduced check imaging and optical recognition software both upstairs in exceptions and downstairs in deposit processing in 1994. With check imaging, a high-speed camera makes a digital image of the front and back of each check as it passes through the reader-sorter, and the images can be stored on a central computer. Optical recognition software reads and stores check and deposit slip amounts. The new technology removed two major bottlenecks. First, paper checks no longer needed to be passed from one worker to another; the information on every check was simultaneously available to any authorized employee in either of the two departments. Second, it reduced the time that proof machine operators spent reading and recording the amounts on checks and deposit slips, an extremely labor-intensive task.

But this still left many tasks that did not lend themselves to automation because they could not be fully described in a sequence of if-then-do steps. Managers of the two departments were responsible for determining how these remaining tasks would be configured into jobs.

INCREASED SPECIALIZATION DOWNSTAIRS

In deposit processing, Cabot Bank managers reorganized tasks and jobs according to a standard template recommended by its imaging equipment vendor. Under the template, a check first goes to a preparation area where work-

DOWNSTAIRS

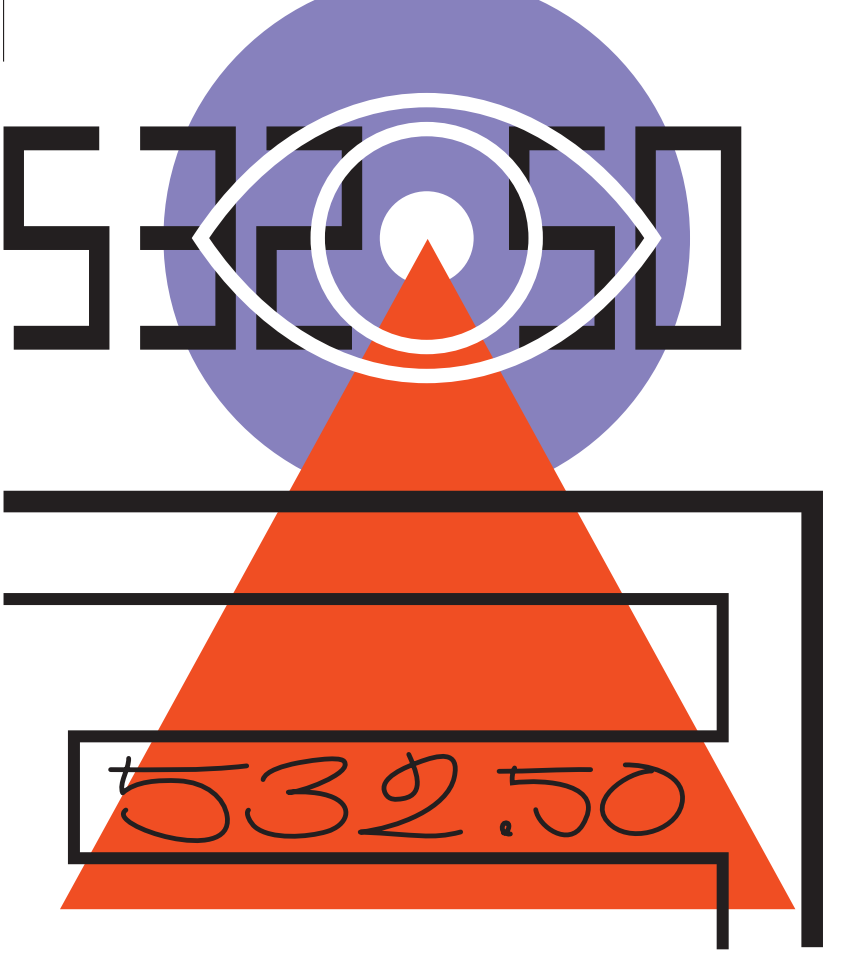
CHECK PROCESSING

The introduction of check imaging and optical recognition software reduced the number of employees downstairs from 67 to 53. It also resulted in more specialized jobs, with check preparers earning less than proof machine operators had, and image balancers and keyers earning more.

	TASKS			
	Prepare checks: remove staples and ensure checks face in same direction	Key in amount on checks with clear printing or handwriting	Decipher amounts on checks with poor handwriting and key in amount	Balance the deposit
1988				
Job title	Proof Machine Operator			
Hourly wage (1998$)	$10.03			
Number of FTE workers per million checks (Total employees=67)	67			
1998				
Job title	Check Preparer	Computer	Keyer	Image Balancer
Hourly wage (1998$)	$9.51	–	$10.00 + incentives	$11.00
Number of FTE workers per million checks (Total employees=53)	16	–	15	22

SOURCE: David H. Autor, Frank Levy, and Richard J. Murnane, "Upstairs, Downstairs: Computers and Skills on Two Floors of a Large Bank," *Industrial and Labor Relations Review,* April 2002.

ine tasks into separate jobs



ers remove paper clips and staples and make sure that all checks face in the same direction. Workers then deliver the checks to a machine that performs several processes: it magnetizes the ink on the MICR line, reads the check, sprays an endorsement and sequence number on the back, microfilms the front and back, and sorts it based on routing information. Finally, optical recognition software scans machine-printed and handwritten numeric amounts, identifies them, and stores the information. (As of 1999, the software successfully identified the amounts on about 57 percent of imaged checks.)

The template also includes processes for when a dollar amount cannot be recognized by the software. The check image is sent to the screen of a high-speed keyer who tries to identify the amount by looking at the numerical image on the right side of the check. If the high-speed keyer is still not sure of the amount, he or she passes the check image electronically to a low-speed keyer. This operator looks at the image of the whole check and, by comparing the numerical representation to the amount written in words, determines the value and keys it in. Once in the system, multi-check deposits are compared with deposit slips automatically. When discrepancies arise, a worker whose title is "image balancer" tracks the images electronically and performs the error detection and correction that was formerly done by the proof machine operator.

The resequencing of the tasks of deposit processing suggests that as computers reduced the cost of moving check information between workers, it became cheaper to divide the tasks previously performed by the proof machine operator into several specialized jobs. More specialized jobs led, in turn, to a modest increase in wage dispersion in the department; the wage for each job depended, in part, on the scarcity of the relevant skills within the workforce. Removing staples and ensuring that checks all face in the same direction are tasks that most adults with average eye-hand dexterity can accomplish with no training. The hourly pay for this job, $9.51, was the lowest in the bank's two departments and about 5 percent less than proof machine operators had made before the reorganization. (See table.)

Image balancing required somewhat scarcer skills. Like the proof machine operator, the image balancer must be able to figure out why some deposits do not balance. But the image balancer must know how to use computers and how to do the work using electronic images instead of paper checks. Managers in deposit processing recruited former proof machine operators because they had already demonstrated the requisite problem-solving skills. The bank provided 36 hours of classroom training followed by two weeks of support from an experienced image balancer. In the end, most proof machine operators made the transition, suggesting that modest amounts of training could impart the requisite computer skills. In 1998, the average pay of the image balancers was $11 per hour, 16 percent more than the rate for check preparers and about 10 percent more than proof machine operators had earned previously.

The department's highest wages were paid to the best keyers. The bank had an economic incentive to hire and reward workers who keyed rapidly, since this reduced the number of keying workstations the bank needed to purchase and maintain. While check preparers and image balancers were paid an hourly rate, keyers were also paid a bonus based on speed and accuracy. (Keying performances could now be monitored by computer, which simplified the determination of bonuses.) The best keyers earned $13.50 an hour, $2.00 per hour more than image balancers. This comparatively high wage reflected the relative scarcity of the skill of recognizing and recording check amounts extremely rapidly and accurately.

The introduction of computers into deposit processing led to the replacement of high school graduates by machines. The number of workers needed per million checks dropped from 67 to 53, and the share of departmental employees with an education beyond high school—primarily managers—increased. (Because acquisitions led to rapid growth in the number of checks processed, job reductions were accomplished without layoffs.) The substitution of machines for less-skilled workers is likely to increase as the character-

After the reorganization, upstairs clerks received exten

recognition software improves and more checks can be read by machine. Similarly, changes in regulations that permit banks to provide customers and banks with images of checks, rather than the checks themselves, may eliminate the jobs of many low-skilled workers who package checks for transit. Finally, since keyers no longer work with paper checks, there is no reason why they need to be located where the checks are digitized. Competitive pressure may push much of the less-skilled clerical work to low-wage, offshore locations, with significant job loss for less-educated workers in the parent plant. One bank, Sun Trust, recognizing that its keying operation outside Atlanta was particularly efficient, began transmitting images of checks from many sites around the country to Atlanta for keying.

INTEGRATING RESPONSIBILITIES UPSTAIRS

Upstairs in exceptions processing, the introduction of computer technology was handled differently. Managers believed that check imaging would produce large efficiency gains even with no other changes because employees would be able to spend less time searching for paper and more time resolving exceptions. But the vice president in charge of the department was determined to accomplish more. He thought that a broader reorganization of tasks and jobs could improve productivity and customer service, and result in better assignments using more skills. In his words: "fewer people doing more work in more interesting jobs."

He also believed that getting employees involved in the job redesign would use their knowledge and gain their commitment to the new system. Even before imaging technology was implemented, managers held focus groups asking workers about the aspects of their jobs that were irritating and seeking advice on changes that would make the jobs better. The consensus: work should be divided by customer account not exception type, and the same representative should deal with all exceptions—stop-payment requests, overdrafts, and so on—for a given account. In that case, a clerk who saw a stop payment order would be able to anticipate a possible (incorrect) overdraft exception as well as other exceptions from the same account. Although the reorganization would not be cost-free—employees would spend 80 hours in training (40 hours in the classroom and 40 hours on the job) to learn to handle the full range of exceptions—management accepted the plan.

While the new account-based workflow was designed in anticipation of check imaging, the bank began implemen-

UPSTAIRS

EXCEPTIONS PROCESSING

As in routine processing, computer technology reduced employment dramatically (650 to 470). But previously separate jobs were redefined to be more integrated, training and pay rose, and Cabot started to recruit more college grads for the positions.

	TASKS			
	Verify signatures on checks written for large amounts	Implement stop-payment orders	Handle overdrafts	Move check information from one clerk to another
1988				
Job title	Exceptions Processing Clerk	Exceptions Processing Clerk	Exceptions Processing Clerk	Exceptions Processing Clerk
Hourly wage (1998$)	$10.64	$10.64	$10.64	$10.64
Number of FTE workers per million checks* (Total employees=650)	98	98	424	30
1998				
Job title	Exceptions Processing Clerk			Computer
Hourly wage (1998$)	$13.50			–
Number of FTE workers per million checks (Total employees=470)	470			–

*Breakdowns by category are manager's estimates in 1994

SOURCE: David H. Autor, Frank Levy, and Richard J. Murnane, "Upstairs, Downstairs: Computers and Skills on Two Floors of a Large Bank," *Industrial and Labor Relations Review*, April 2002.

sive training and higher pay

tation before imaging technology came on line. The immediate result—a surprise to managers—was a major improvement in productivity. Before the reorganization, 650 workers processed the 65,000 exceptions each day; after the reorganization, this workload took only 530 workers. Given the productivity gains, we wondered why Cabot had not tried this earlier. Managers told us that Cabot had been focused on absorbing newly acquired banks and, therefore, had not considered such a reorganization. It is also possible that the reorganization of work became compelling only when managers knew that the gains would be enhanced by the additional savings that image processing made possible.

Once imaging was introduced, exceptions processing became even more efficient. Clerks no longer spent time shuffling paper checks or searching for a check when answering a query from a branch bank. One year later, the number of workers had fallen to 470, a 28 percent decline overall. Reorganization accounted for about two-thirds of productivity gains, new technology for the other third. Because the department had high turnover, staff reductions were achieved through attrition. As in deposit processing downstairs, almost all of the 180 positions eliminated were held by high school graduates.

In contrast to deposit processing, however, the reorganization in exceptions processing led to formerly specialized jobs being combined into broader ones. And since exceptions processing clerks now had more extensive training and could handle a wider variety of tasks—skills valued by Cabot's competitors—management decided it was prudent to pay higher wages. The average wage for lower-level, nonsupervisory workers rose from $10.64 an hour in 1988 to $13.50 in 1998. Most workers were also moved up a pay grade after they completed training. In addition, management steadily increased the proportion of employees they classified as "exempt," that is, workers who were required to work independently, show initiative, or supervise others. Before the reorganization, 20 percent of the unit's workers were exempt; by 1998, the number was 35 percent.

Management also expanded the range within each pay grade. For example, grade 23—a grade to which many representatives were initially assigned—had a 1993 range of $17,800 to $26,300 but a 1998 range of $18,900 to $37,100. The greater pay range reflected the firm's belief that employees had greater scope for judgment and initiative in the redesigned job. In particular, management wanted to motivate employees not only to do their own complex jobs well, but also to recommend additional design improvements. Said the vice president, "If you transform your job in a positive way, you will get a raise. If you transform your job and have a positive impact on the people around you, you will get a promotion." Although expanding the pay range may simply have reflected external market forces that were leading to greater wage dispersion throughout the economy, there was no comparable expansion within each pay grade downstairs in deposit processing.

Also somewhat different was the response to the demand for higher skills that the reorganization engendered. Although training went a long way, particularly in imparting the relevant computer skills, many managers upstairs found that the ability to "see the whole picture" was difficult to teach. Accordingly, Cabot restructured its recruiting process in exceptions processing to identify job candidates with a history of taking initiative and problem solving. For example, they asked prospective hires to describe problems they had encountered in previous jobs or in school and how they resolved them. Candidates were also interviewed by supervisors from several groups and could only be employed if multiple supervisors vetted the hire. In the words of one manager, "[recruits] have to be right for the whole bank."

Managers in exceptions processing reported that the new recruiting process favored applicants who had at least some college education. Had managers retained the narrow task structure, computerization certainly would have eliminated the jobs of many high school workers engaged in the "paper chase." But the broader job responsibilities also spurred managers to recruit college graduates into the department, something they had not done before.

Was the new job design inevitable? Seemingly not, at least

in the short run. Management had considerable discretion to either broaden the exceptions processing job or leave the previous job design intact. Some banks have kept jobs in exceptions processing specialized by function, even after introducing check imaging. Not enough time has elapsed to judge whether the different ways of organizing work in exceptions processing reflect equally productive ways of organizing the tasks, or whether competition will reveal that one way is more efficient than others. But we suspect that Cabot Bank's choice effectively takes advantage of the interdependencies among exceptions-processing tasks and will be rewarded by the market in the long run.

CONCLUSION

So why did things at Cabot turn out one way downstairs and another way upstairs? Research by Professor Assar Lindbeck of Stockholm University and Dennis Snower of the University of London suggests that managers combine tasks into broader jobs when the tasks are complementary and create single-task jobs that take advantage of specialization when they are not—for example, in Adam Smith's pin factory. It seems likely that the reason new technology resulted in narrower job definitions in the Deposit Processing Department downstairs at Cabot Bank is that there was little complementarity among the tasks. Once imaging reduced the cost of moving check information from one worker to another, it made sense to exploit economies of specialization. On the other hand, complementarity among tasks in the Exceptions Processing Department upstairs made task integration attractive.

This appears not to have been the only consideration, however. Upstairs managers also seemed to have the explicit goals of making jobs more interesting and in involving the workers in the redesign. MIT Professor Paul Osterman has pointed out that where managers care about the quality of customer service and the well-being of employees, we tend to see integrated job designs. ❊

David H. Autor, is assistant professor at the MIT Department of Economics, and the National Bureau of Economic Research; Frank Levy is professor at the MIT Department of Urban Studies and Planning; and Richard J. Murnane is professor at the Harvard Graduate School of Education, and the National Bureau of Economic Research. This article is based on "Upstairs, Downstairs: Computers and Skills on Two Floors of a Large Bank," published in the *Industrial and Labor Relations Review*, April 2002.

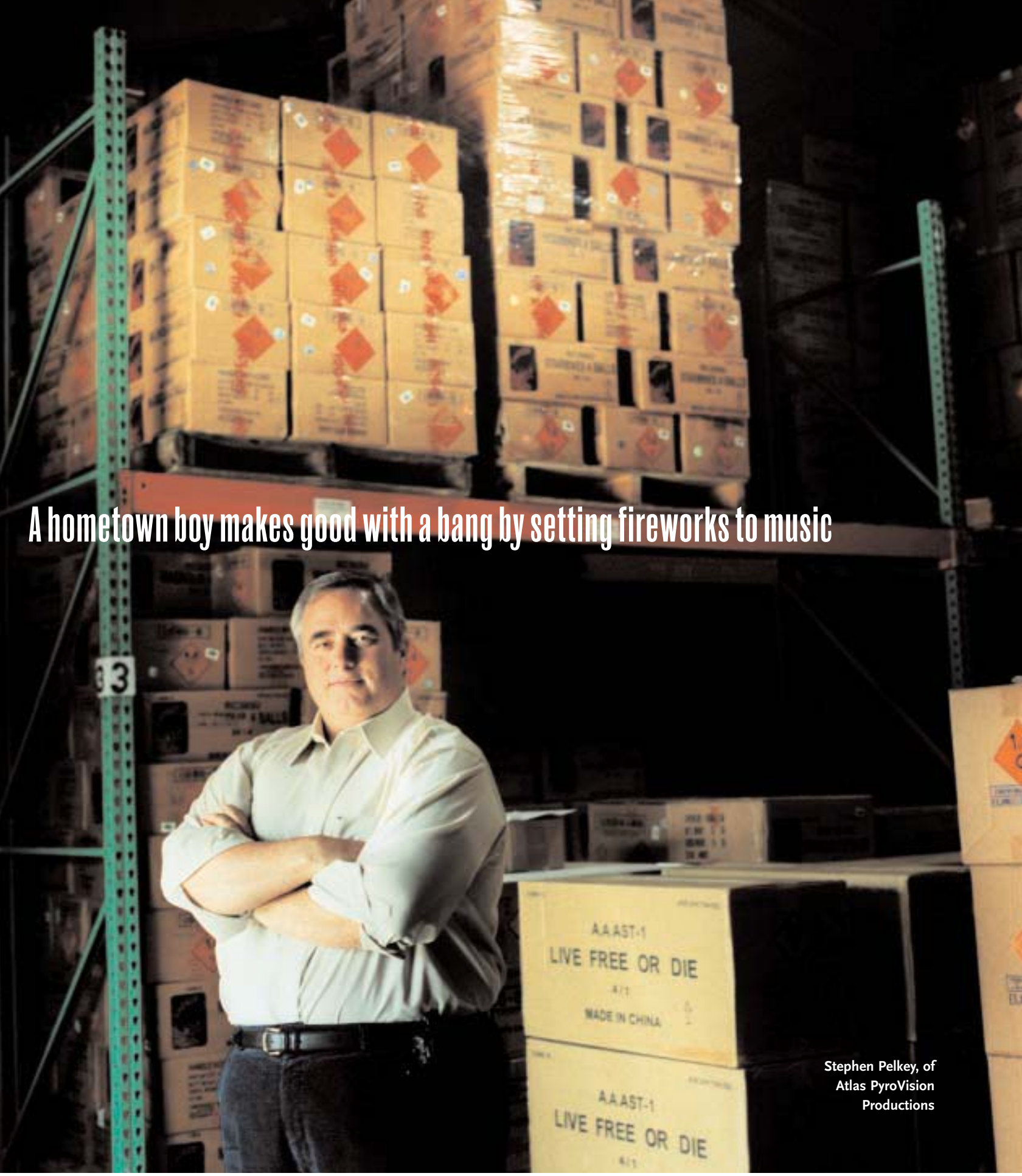
letter from Jaffrey, New Hampshire

Business is kabooming

By Jane Harrigan § Begin with a glittering silver chrysanthemum, 1,000 feet wide, exploding over the Washington Monument on the Fourth of July. Proceed to Boston, where, with each cymbal crash of the "American Symphony," the pistils of giant red flowers strobe 1,000 feet above the Charles River. Take your pick of 700 other fireworks displays from Miami to Minnesota to Montreal. If you could follow a string of colored stars from all these productions back to their source, the trail would end at a tan, brick, and metal building on a rural road in southwestern New Hampshire. Here, behind a door guarded by jade lions, the 22 employees of Atlas PyroVision Productions choreograph the displays that illuminate the nation.

Here in Jaffrey, population 5,500, handmade shells designed to Atlas's specifications arrive from Spain and Japan and China and accumulate in three concrete-walled magazines holding 60,000 pounds of explosives each. Here, the latest computer equipment calibrates the precision firing of a crude product that has changed little since the Chinese invented gunpowder over 1,000 years ago. Here, Stephen Pelkey,

A hometown boy makes good with a bang by setting fireworks to music



Stephen Pelkey, of Atlas PyroVision Productions

PHOTOGRAPHS BY KATHLEEN DOOHER

Computers calibrate the precision firing of a product little changed since the Ch

the hometown boy who made good with a bang, surveys a decade of 800 percent growth and distills a simple lesson: In life, as in fireworks, timing is everything.

When Pelkey took over the fireworks company from his father-in-law in 1986, it was a typical mom-and-pop operation. Pelkey does not pretend to have foreseen the combination of circumstances that took Atlas from the $500,000 business to the nearly $5 million in annual sales it does today. He didn't predict them, but he's happy to list them: Computer technology took off. The economy boomed. Corporations started sponsoring municipal displays as advertising. First Night celebrations and ski resort shows extended the fireworks season year-round; concerts, ice shows, and sports events brought pyrotechnics indoors. All Atlas had to do, Pelkey says, was hire people with imagination and take advantage of the technology.

In its early days, Atlas manufactured shells and sold them to volunteer fire departments that shot small-town displays. Pelkey and his wife, Dee, immediately began dreaming of something more. They drove to Montreal for the international fireworks competition, taking notes on technology and artistry as the icons of the pyrotechnic world fired off displays set to music. The couple made the trip eight times, but it had taken only one night for Pelkey to read the writing in the sky: "After seeing that first show, I knew this was exactly what I wanted to do." He invested in a basic computer firing system and began to practice coordinating fireworks with music.

More than 400 companies in the United States shoot fireworks, but only about a dozen can put together the equivalent of a Pyrotechnic Symphony, a name Atlas has trademarked. By feeding individual pieces of music and reams of statistics about all kinds of shells into a complex computer database, the choreographer of a display can ensure, for example, that a five-inch shell with a lift time (time to achieve altitude) of 3.75 seconds will be shot into the air exactly 3.75 seconds before the moment at which it must burst to complement the music. The shells don't just explode in time to the beat, Pelkey says. They illustrate the music, rising and falling in intensity or tracing piano key strokes across the sky.

Achieving that level of sophistication took practice. "If you're proposing a full-scale production for D.C. or Boston or Disney, they ask, 'Have you done this before?'" Pelkey

Although timing is important, quantity counts, too. In the display over the Washington Mall, Atlas sets off 6,500 separate ignitions. The typical town display uses only about 1,200.

COURTESY OF ATLAS PYROVISION

says. "So we created our own venue." In 1990, Atlas inaugurated the Jaffrey Festival of Fireworks as a way to build confidence through success—and to learn from failure. A frayed clump of wires on Pelkey's desk, which the staff jokingly mounted in Plexiglas, attests to a 1993 incident in which an experimental harness failed and more than 800 shells exploded in 35 seconds. The audience loved it. Pelkey now cringes if one of his computerized creations fires a hundredth of a second early.

Today, the Jaffrey Festival is the largest show on the East Coast. The typical town fireworks display involves about 1,200 "cues," or separate ignitions. Boston's Fourth of July display has about 5,000 cues; the Washington Mall show has 6,500. The Jaffrey Festival bombards its audience with as many as 8,000 ignitions, including a grand finale that Pelkey calls "absolute sky saturation." Last year on the third weekend in August, 32,000 people paid $6 each, or $30 per carload, to come to

inese invented gunpowder

town and have their socks knocked off.

Emboldened by its success in Jaffrey, Atlas entered the North American Pyrotechnics Competition in 1994—and won. The next year, the company came in fourth in the international competition in Montreal, the same contest that had inspired Steve and Dee Pelkey nine years before. The big contracts started rolling in: The Major League Baseball All-Star Game. The World Wrestling Federation. The New England Patriots. The New Year's Eve fireworks in Boston. The nationally televised Fourth of July shows in Boston and Washington.

Kaboom! Like the best fireworks displays, the company's explosive growth was both terrific and terrifying. "It's easy to say 'yes' to whoever calls," Pelkey says. "But will you have the trained technicians, equipment, and inventory to pull it off?" Even now that growth has slowed, such questions linger. Each year, Atlas does 80 percent of its business in two weeks. (When things calm down in mid-July, Pelkey falls into what he calls "post-pyro depression.") The compressed timing means the company must supplement its full-time employees with 900 part-time technicians, each of whom must be trained every year in the latest firing techniques and regulations. It also means that although 96 percent of the shows Atlas shoots do not use computerized firing, the company needs six $80,000 field controller computers, or "pyrodigital firing systems," for the 4 percent that do, because many of those shows happen at the same time.

Not only is the schedule compressed, but creation is a one-shot deal. Fireworks choreographers spend months planning a show that they never get to rehearse; the first time they see it is when the audience does. "You have only one chance to make it work," says Matt Shea, Atlas's director of marketing. "If things are going badly, we can't tell the customer, 'We didn't quite get it done. Could you wait until July fifth?'" ✳

Jane Harrigan is a professor of journalism at the University of New Hampshire. She hopes her family will follow her wishes and pack her ashes into a fireworks shell so she can go out with a colorful bang.

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At nearly 50 years old, modernist structures like CIGNA's Wilde building in Bloomfield, Connecticut, are now candidates for historic preservation. **Page 14**

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