

## **Finding Free Lunches New Ways to Measure and Manage Productivity**

*By Del Jones<sup>1</sup> and Shlomo Maital<sup>2</sup>*

*There are no free lunches*, Nobel Laureate Milton Friedman once said. He meant that every time we consume real resources, there is an economic cost; *someone* always provides and pays for the corned beef on rye, hold the mustard.

But growing numbers of companies are using an economic concept known as total factor productivity (TFP), or multi-factor productivity, to identify and capture enormous free lunches. They do this by squeezing more production and sales out of existing resources. The beauty is, when they succeed the results go directly to the bottom line. In times of global deflation, when falling prices put severe pressure on profits and profit margins, TFP free-lunch gains are positively life-saving.

### ***Why Productivity is Crucial in the Age of Deflation***

Managing and measuring productivity are important for all companies, at all times. But in times of global deflation, shrinking demand and falling prices squeeze profit margins. *Only if costs fall faster than prices can profit margins grow.* This is achieved by getting more output out of fewer resources. So for many companies boosting productivity when prices are falling is often a matter of life and death.

Consider manufacturers of computer components and electronic assembly. In this sector, the price erosion is about 6% per year, hence companies have to cut costs by at least 6% per year or see profits decline.

For example, a liquid crystal display panel firm in Singapore told us that the price of the "screen" for a game console (a famous one) fell by more than half, in three years, from US\$2.80 to \$1.30. For this firm unless productivity grows rapidly, profits simply evaporate under price pressure.

Conference Board economist Ken Goldstein comments: "A profit squeeze helped set off the recession. So business has taken steps....productivity (in America) began rising significantly in the 3rd Q. of 2001 and continued through this year...as a consequence, profits recovered \$100 b. of the \$200 b. lost prior to the recession".

### ***TFP Among Fortune 100 Companies: Key Ways to Find Free Lunches***

In examining Fortune 100 companies, we discovered that in the current US recession, unlike those in the past, productivity has continued to rise.<sup>3</sup> (See Graph). Companies no longer stockpile labor and ride out the recession. They act at once to slash redundant labor and squeeze out unnecessary costs. Here are some examples:

- **Use technology:** Health care wholesaler **McKesson**, that distributes drugs to drugstores and hospitals, slashed its distribution centers to 30 from 50, while boosting revenue from each by 5 times. A small example of an almost-free lunch, according to CEO John Hammergren: warehouse workers wear laser scanners on

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<sup>1</sup> Del Jones is senior staff writer at USA Today.

<sup>2</sup> Shlomo Maital is Academic Director of TIM-Technion Institute of Management, Atidim Science Park, Tel Aviv, Israel.

<sup>3</sup> See "Productivity Grows in Spite of Recession", USA Today, Monday, July 29, 2002, Money Section, pp. B1-2. This was the third annual USA Today survey on TFP growth among Fortune 100 companies; the fourth will be published again in late June or early July.

their wrists that tell them where every item is in the warehouse; no time is wasted on prolonged searches, as in the past. The scanners were not free -- but likely paid for themselves within weeks. They boosted order accuracy to 99.9% and cut inventory, because McKesson knew in real time what it had. That slashed the need to maintain safety stock.

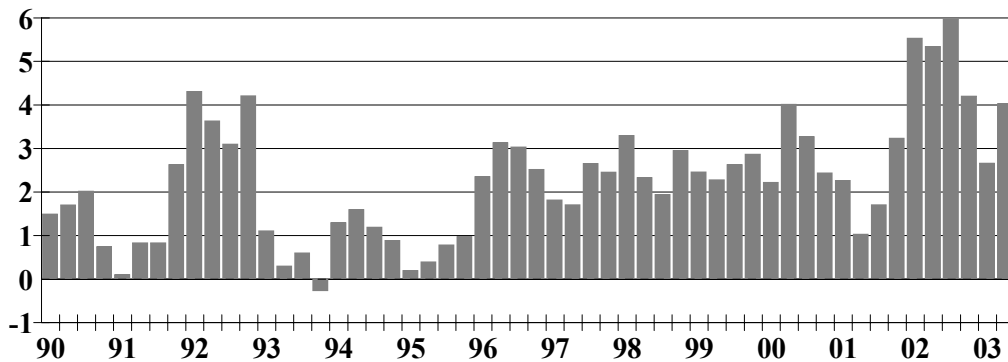
✓ In two years McKesson's revenues increased 38% with no increase in employment. McKesson's productivity-boosting activities were so impressive, Wal-Mart -- itself an obsessive productivity booster -- named McKesson a supplier of the year and turned its pharmaceutical bulk packaging over to a McKesson facility in Tennessee.

✓ Warehouse workers at Amerisource - Bergen wear a similar technology that they call gladiator gloves. They too direct the worker to the precise location and a swipe of the bar code decreased errors dramatically.

✓ Sprint continues to replace human operators with voice recognition technology and increased revenue 4.3% in 2002 with 11,500 fewer workers on the payroll.

Technology spending has leveled off in recent years, but don't let that fool you, Microsoft's Bill Gates told us. He said companies are getting increasing productivity results from the same amount of tech spending.

## U.S.: Business Sector, % Change Output Per Hour



*Transformation: %Chg, YA      Source: Bureau of Labor Statistics*

**Figure One.**

### Productivity Growth, US Business Sector, 1990 - 2003

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✓ A Pepsico deliveryman who walks into a 7-eleven is equipped with a handheld computer that has a wireless connection to a database. He instantly knows that this 7-Eleven is in a Hispanic neighborhood where spicy Doritos are popular. The next-day's order is boxed in advance for each store, allowing the delieveryman to visit more stores per day and Pepsico to operate with fewer people and fewer trucks.

✓ Productivity gains may be even more impressive at small companies. Internet banking company NetBank has \$2.4 billion. A typical retail bank of that size

would employ about 2,000, but NetBank does it with 180. Between May 2002 and May 2003 the company's wholesale mortgage lending unit hired 14% more workers but originated 101% more loans.

✓ No industry is untouched. *The nation's dairies are producing 25 percent more milk with 17 percent fewer cows than 20 years ago.*

- **Save time:** At **General Motors**, when assembly lines broke down, technicians once looked up the problem from a library of manuals. Now, touch screens right at the assembly line produce immediate diagnoses, shortening line shutdowns.

- **Dump unproductive businesses:** PepsiCo spun off ailing low-productivity units Taco Bell, Pizza Hut and KFC restaurants, focusing on high-profit beverages and snack foods. For 1996-2000 TFP gains averaged 33% yearly.

This can work in reverse. When the much smaller AoL internet service provider acquired media giant Time Warner, revenue for the company leaped 455 percent. Employment rose 495 percent and assets exploded to \$209 billion from \$10.7 billion, or 1,853 percent. TFP plunged 98%, twice the drop of any of the 100 largest companies in 2001.

- **Refocus on high-productivity businesses:** **AutoNation** concluded that capital and labor tied up in used-car superstores was a dead asset. By closing them and reinvesting the capital on new-car sales, it achieved TFP gains averaging 75% yearly in 1996-2000, as its shareholders' capital and workers focused on more productive businesses.

Wal-Mart CFO Tom Schoewe told us the company had seen its return on assets slip from 9.6 percent in 1998 to 8.5 percent in 2001. But it jumped back to 9.2 percent in 2002 as it sold or leased 13 million square feet of vacant space, turning old stores into schools, auto dealerships, fitness centers, and churches, such as Calvary Chapel in Belen, N.M.

American Express outsourced its technical support to IBM, transferring 2,000 employees to IBM's payroll in 2002. *American Express now pays only for only the technology expertise it needs*, and those experts are free to solve tech problems at other companies. That boosts productivity both for American Express and for IBM. American Express boosted revenue \$1.2 billion in 2001 with 9,000 fewer employees.

- **Innovate, innovate:** the single biggest source of free lunches for companies is hot new innovative products that boost sales without added resources or inputs. Global 500 firm Nokia increased its sales in 1996 by 20% with stylish new cell phones cleverly marketed; but the number of Nokia employees fell slightly and invested capital rose only by about 1%. The result: growing profitability and profit margins. GE did the same in the year 2000. (See "Crunching the Numbers"). So did Pfizer, with its new drug Viagra.

### ***How does TFP differ from existing metrics?***

Many companies use a variety of individual metrics to measure the productivity of capital and labor.

- \* EVA (economic value added): measures the productivity only of capital; not suitable for companies whose human assets are more important than capital assets.
- \* RoI (return on investment) - focuses only on capital
- \* Value added per worker - doesn't tell the gain in labor productivity came from higher capital assets or from the free-lunch variety, and *why*, it happened.

Many companies focus single-mindedly on capital productivity, using rate-of-return measures such as RoI, RoA or EVA. This is particularly true of European firms. Such measures are highly misleading, because they other ignore key dimensions of productivity gains, accruing from more productive *labor* and finding free lunches (TFP).

TFP is a metric that distills data into a single measure that shows bottom-line profitability gains, and reflects how productive *both* capital and labor are. Here is how. (See "Crunching the Numbers")

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### **Crunching the Numbers**

**1. Start with the conventional measure of labor productivity growth:**

**year-to-year % change in value added  
per employee**

*( if you are using annual-report data: replace value added with sales revenue.)*

**2. Subtract from this the part of productivity growth caused by higher capital investment:**

**SUBTRACT:**

**0.4 times year-to-year % change  
in capital assets per employee**

**EQUALS:**

**3. The result is: year-to-year % change in TFP (the Free Lunch)**

**year-to-year % change in  
total factor productivity**

**Example:**

GE increased its sales revenues by 16% in 2000 with essentially the same number of employees and with an increase of only 8% in its capital assets per employee. (See Box). The result: A very large increase in 'free lunch' (TFP) productivity.

<b>TFP Change at GE: 2000</b>			
	<b>2000</b>	<b>1999</b>	<b>% change</b>
<b>GE Basic Data:</b>			
<b>Sales</b>	<b>\$129 b.</b>	<b>111.6 b.</b>	<b>+16.3 %</b>
<b>Employees</b>	<b>341,000</b>	<b>340,000</b>	
<b>Assets</b>	<b>\$437 b.</b>	<b>\$402 b.</b>	
<b>Change in Sales per employee:</b>	<b>+ 16%</b>		
<b>Change in Assets per employee:</b>			<b>+7.5%</b>
<b><u>TFP change: + 13 per cent</u></b>			
<b>= 16% - 0.4 x 7.5% = 16% - 3.0% = 13 %</b>			

**The Origins of TFP**

MIT Professor Robert Solow won the Nobel Prize in economics in 1987 for "contributions to the theory of economic growth". Solow asked: Why are some countries wealthier than others? He noted two answers: a) the Marxian answer: "Wealthy countries saved more and accumulated mountains of physical capital", (e.g. Singapore; see below), and b) the National Energy answer, "Wealthy countries found smarter ways to use their resources and make them more productive" (e.g. Hong Kong). He invented the TFP equation that partitioned higher output per worker into two components, a) and b), and found b) was far larger. He agrees that the same tool can be applied to discovering why some *companies* are wealthier than others. When this is done, the same answer (not surprisingly) is discovered: Growing profitable companies have higher rates of TFP growth.

**Why TFP is No Panacea**

It is very important for managers to realize that their quest **begins** with the TFP metric, rather than ends. Large TFP gains raise the question: Where precisely did they come from? New products? More motivated workers? Spinning off unproductive SBU's? And how can the TFP momentum be preserved? Poor TFP growth, of course, raises the question, why? Why are resources not more productive? Does the problem lie with wasted labor? or wasted capital? How can this waste be eliminated? Only when those questions get systematic answers will the TFP metric lead to structured changes that perpetuate those gains.

**Singapore and Hong Kong: Lessons for Managers**

Singapore and Hong Kong are each city states, limited in their land areas and similar to successful businesses; each have achieved rapid growth and high per capita GDP

of around \$25,000. But a study by economist Alwyn Young<sup>4</sup>, using the TFP concept, reveals a surprising difference: If Singapore had shareholders, they would be exceedingly unhappy, while Hong Kong "shareholders" would be in seventh heaven. The reason: Singapore's growth was achieved the expensive, hard way, with enormous capital investments and with no 'free lunch' TFP growth, hence very low capital profitability, while Hong Kong's growth was mainly of the free-lunch variety. According to Young's study, "fully 56% of the increase in output per worker in Hong Kong between 1971 and 1990 is attributable to TFP growth" [ (i.e. the 'free lunch')]; "in the case of Singapore TFP growth contributed minus 8 %" [i.e. there was absolutely no free lunch].

### ***TFP Among High-Tech Firms: Take the Long View***

A study of TFP growth among high-tech firms in Singapore, by Nicholas Baratte (JP Morgan) reveals:

Firms can be classified in 3 groups:

- The consistently bad - low or negative TFP over a number of years,
- The inconsistent... huge variations in IC, margins... making the TFP growth quite difficult to interpret, and
- The consistently good - firms with positive TFP. Most of these firms have 1 or 2 bad years over the period of 6 years we studied... (For Intel, this occurred when implementing a new technology, such as a 300 mm. silicon wafer).

Conclusion: it is dangerous to look at a single-year of TFP growth and draw conclusion. But over longer periods of time (say, five years) TFP growth shows very good correlation with other indicators of good management (high margins, low working capital, high ROE and ROIC...). So TFP is probably a component of competitive advantage of a firm and is also a positive barrier to entry. Its advantage over other conventional metrics is that tends to lead them in time -- higher TFP growth is generally followed by higher profitability in later years.

### ***The European Angle***

With Europe's economy growing slower than elsewhere, some observers have claimed that European companies are less innovative and less productive than those in Asia and America. A TFP study by Forrester Technology<sup>5</sup> reveals that TFP growth among leading European companies matches that in the United States. The conclusion: Rigidities in European goods, capital and labor markets, regulation, bureaucracy and bloated public sectors and government owned firms are a major cause of European stagnation, and not private-sector firms.

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<sup>4</sup> Alwyn Young. "A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore". NBER Macroeconomics Annual 1992, ed. by Olivier J. Blanchard and Stanley Fisher, MIT Press, Cambridge, MA., 1992.

<sup>5</sup> Charles Homs. Understanding IT's Impact on Productivity. Forrester Associates: TechnoStrategy™ Report, November 2002.

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### **Productive Cows: TFP on the Farm**

EVANSVILLE-- The Larson family owns a 1,200-cow **dairy** farm in southern Wisconsin, but it's been decades since any of them have actually milked a cow. Instead, cows, wearing collars with computer chips, are hooked up to electronic milkers in a sterilized room with stainless steel machines that measure and graph each cow's production to the last drop. Cows with low milk output are immediately corralled by electronic gates into the "hospital wing" where they can be treated and put back into the line.

"In 50 years, things have changed a lot," Ed Larson says as a John Deere screensaver flickers on the computer in his office, remembering how he used to get up at 5 a.m. as a kid to milk on the family farm before heading off to school. Largely in response to falling milk prices, which recently hit the lowest level in 25 years, a new **dairy** economy is emerging in which extended families with large herds and specialty boutique farmers, like those going organic or making fine cheeses, are pulling ahead. Farmers have found that the only way to survive is to increase output or to find a niche that commands higher prices.

Faced with costs of adaptation that can run into the millions of dollars, thousands of farmers, many of them from small operations, are dropping out of dairying every year. Last year, farmers shut down 6,000 dairies -- an average of 16 each day. Some farmers and consumers lament the trend toward fewer farms, saying it threatens an endearing symbol of Americana -- the small family farm.

But many **dairy** farmers argue it just spells a different, and in many ways, better, chapter in the life of U.S. farming. A farm that runs less like a home and more like a business means fewer 4:30 a.m. wake-up milking calls and more time for things like vacations and golf tee times. "This is a family farm. It just looks a little different," says Mitch Breunig, 33, who owns Mystic Valley **Dairy** in Sauk City, Wis., with his mom, dad and a partner who was a longtime employee at his parents' farm.

Mystic Valley milks 400 cows 15 hours a day. The barns feature a cooling system with misters and fans and a lighting system meant to mimic daylight to maximize herd health and to boost output. Breunig, who has a degree in **dairy** science from the University of Wisconsin-Madison, says it's frustrating that other industries are encouraged to innovate but changes in farm country seem to prompt an outcry.

"We do it because we love it, but we'd like to make money, too," he says.

Says George Crave, who with his brothers converted his milk farm in Waterloo, Wis., into a specialty-cheese producer: "We're raised that you don't talk about making money. It's a lifestyle. It has to be in your blood. It's too much work if it's not."

### **Rising output, falling prices**

There were 92,000 **dairy** farms dotting the countryside in 2002. That's one-fifth the number of U.S. dairies in 1975.

It's a trend that will only continue. In a survey of Wisconsin **dairy** farmers taken a little more than a year ago, 20% said they planned to stop milking by May 2007. "It gets harder and harder for the small farmer to stay in business," says farmer Gary Lien of Brooklyn, Wis. After years of struggling with low prices and rising debt, Gary and his wife, Jody, sold their 108 Holstein milk cows at an auction on their farm in mid-May.

Low prices over the past two years have made it even more difficult for farmers like the Liens to stay afloat. Prices paid to farmers for their milk have fallen 30% since their September 2001 peak and recently hit their lowest since 1978.

As in many other industries in the USA, **dairy** farmers have become victims of their own success.

Using high technology and cutting-edge research on feed and genetics, they have boosted milk output per cow more than 50% in the past 20 years. Non-farm business productivity has risen a similar amount.

Although the number of **dairy** cows in the USA has fallen 17% to 9.1 million in the 20 years through 2002, total output has risen 25% during the same period. For a while, the market welcomed the higher output, as demand for milk products, especially for cheese to top pizzas, grew. Prices stayed high, prompting higher production as farmers sought to cash in.

But over the past few years, demand has stagnated. Industry experts blame that on a number of factors, including less restaurant dining in the past few years because of a sluggish economy and post-Sept. 11 lifestyle changes. Less eating at fast-food restaurants has also taken a toll, they say.

"The fact is, the demand went soft," says Bob Cropp, a **dairy** marketing specialist at the University of Wisconsin-Madison. "That has really, really affected farmers." Although wholesale prices are down by double digits, retail prices for **dairy** products have fallen only about 5% during the same period. That has frustrated farmers and has even sparked a government inquiry in New York state.

Recently there have been a few signs that production, in part owing to heat in California that decreases milk yields, is starting to weaken. As a result, prices paid to farmers for their milk last month rose to their highest level of the year.

### **Adapting to change**

The average U.S. herd size has tripled in the past two decades to 99 cows per farm. In what economists call "economies of scale," greater production is needed to increase revenue and pay for equipment and technology, farmers say.

Gary Frank, former director of the Center for **Dairy** Profitability at the University of Wisconsin-Madison and a former **dairy** farmer, says there's another motivation. "What happens is the rest of the world moves on and they have vacations and health care and weekends off and so on, and farmers say, 'How do I do that?' " he says. "You don't do that with 50 or 100 cows in the family operation. You need to get to 500 to 1,000 cows."

The Larson family has expanded from 175 milking-age Holsteins in 1998 to 1,200 today. The high-tech operation supports seven subsets of the Larson family, led by brothers Donald, Ed and Mike and their wives, children and extended family. About a dozen others are employed at the farm.

When their grandparents ran a **dairy**, farmers bragged about how many days they had gone without missing a milking, whether it be in snow, sleet or sickness. These days, with the families splitting the duties, the brothers take time off to play golf or go on vacations.

"I love doing what I do," Ed Larson says. But, "There can't be another job with this much risk."

Lately, the Larsons have come up against a big obstacle. Neighbors have opposed the Larson family's plan to build a \$1.7 million heifer barn to move 1,000 head from four neighboring farms onto the main facility. After six public hearings and \$40,000 in legal fees, the local township approved the facility. But neighbors have since filed a lawsuit.

The Larsons say expansion is necessary to support the family.

Some individuals and organizations worry that larger farms spell disaster for the environment -- a higher concentration of cows equals a higher concentration of manure -- and call some operations "factory farms." But farmers say they use the latest technology to respect the environment. Many use their manure to fertilize crops, which are then fed to their cows, making the farms more self-sustaining.

### **Carving out a niche**

The Crave family decided a few years ago that instead of expanding their 600-herd farm, they would go into the specialty cheese-making business. Brothers Charles, George, Thomas and Mark, who mostly have been working together for 25 years (their other brother is a photographer), wanted to expand the business so that their children could be involved when they grew older. In just a little over a year, they have won awards and are making greater profits from cheese than from milk.

"Our generation had to come into dairying with a business mind-set in order to survive," George says, noting a farmer with a smaller family could not do what he is doing. "The producer in the future is going to have to be a general manager, not a tractor driver, not a milker."

Jody and Gary Lien, the couple who sold their cows in May, do not hold a grudge against the larger farms. Of their three children, only one wants to farm. "They're looking for a different way of life, too," Gary says of the larger farms, squinting slightly at the sun as he sits at a picnic table outside their farmhouse on a cloudless summer day.

Jody and Gary, both 57 and high school sweethearts who grew up on neighboring farms in the rolling hills outside of Madison, say they don't regret their decision at all. Gary is now selling the hay from the farm that used to be fed to the herd. "It will give us opportunities to do things," Gary says, noting they haven't been on a vacation in five years. He's been getting up at 7:30 a.m. these days, two hours later than he had gotten up his whole life.

Jody and Gary now worry about their son, Corey, 28, who is starting a **dairy** farm on their land. Although they have advised against it, they are supporting him, both emotionally and financially.

"I know it will be as tough or tougher for him as it was for me," Gary says. "I don't know how he is going to do it. I don't know if that's the life you should encourage."

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