

Operating at the Rate of Consumption:

Did Inventory Reductions in U.S. Manufacturing Prevent Recessions During the 1990s?

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Sometimes connections appear as if at random, then quickly seem obvious. It was while reading Richard W. Oliver's article, "The End of Inventory?"ⁱ in the January-February, 1999, issue of the Journal of Business Strategy that such a connection occurred to me. This latest connection merely explains the continuity of the ten-year economic expansion in the U.S. between 1990 and 2000. So, modestly, I have decided to throw it out as a hypothesis, and let the economists beat me up.

For America's recession-free decade, Democrats credited President Clinton, who balanced the budget. Republicans credited Congress, who balanced the budget. Economists (and Time magazine) credited Greenspan, Rubin and Summers, "The Committee to Save the World".ⁱⁱ Without diminishing anyone's contribution to the growth of the economy over those past nine years, I suggest that much of the credit for the *stability* of that growth should go to the improved inventory policies and practices of American business, in particular to our manufacturing sector.

Oliver's article argues that inventory is "in a strategic sense, ...the physical manifestation of the lack of information between demand and supply," and that in the information age there is little excuse for owning much of it.

In the U.S. business environment of the Seventies, inventory didn't need an excuse. It was an asset, and a current one, at that. And current assets were "goods". Moreover, thanks to absorption costing, building inventory could increase a manufacturer's profit. I observed a case in point at Rockwell's Draper Division, then America's leading weaving machinery company. A financial planner, I witnessed the division president's order to run the crankshaft line three shifts for the last two months of FY 1972. Normally, it was a one-shift operation. Why did we suddenly need so many loom cranks? We didn't. But, the division was running a bit behind budget on the bottom line, and the Crankshaft Department had an overhead rate of 1000% of Direct Labor Cost. So, on orders from the big boss, the plant manager put enough people in there to run the line three shifts. For every direct labor dollar spent, we applied \$10 of standard overhead to our inventory, without adding materially to our actual overhead spending. We built a three-year supply of X-3 Loom crankshafts in that burst. Management, myself included, got our bonuses for the year, because the over-absorbed overhead generated by that ploy got us back on our profit target.

In 1996 Richard Schonberger used two graphic exhibits as the grabber in the first chapter of World Class Manufacturing: The Next Decade,ⁱⁱⁱ the sequel to his earlier masterpiece with a similar title. Given my industrial experience, the first, Exhibit 1-1, was no surprise. It showed how inventory turnover decreased for a number of America's largest manufacturers over a 25-year period. (Inventory turnover is defined as the ratio of cost of goods sold to inventory. In the absence of cost data, inventory turnover is sometimes expressed as the ratio of sales to inventory.)

Of course inventory turnover fell. The absorption costing ploy described above motivated division managers to run their plants hard, especially near year-end. Expand the Rockwell example to the macroeconomic level, and it leads to slowing inventory turns.

Absorption costing further motivated managers to keep running factories hard, even when demand began to slow down. That way, they would get one more month (or quarter) of good reported margins, then have a general recession to blame for the layoffs and depressed earnings that followed. (I believe that every recession I've witnessed has been longer and deeper than necessary, as the excess inventory built up in this way has been worked off, plants have remained closed and/or workers have remained on lay-off.)

Add to this historical picture the rapid conglomeration (unrelated diversification through acquisition) going on in the Sixties and early Seventies. Under conglomerate management, profit and reported ROI, not customer relationships and cash flow, were the keys to a divisional manager's corporate success. Add next the general lack of controls on inventory decisions (Did any reader have to turn in an appropriation request to build inventory?). Finally, add the proliferation of products going on in the period. Of course there was upward pressure on inventories. Of course inventory turnover in many big companies was falling. Building inventory was profitable... at least on the books.

Since I'd been living, studying and teaching about "the Industrial Renaissance" for over fifteen years when I saw it, Exhibit 1-2 also came as no great surprise. However, I'd not realized that the upturn in manufacturing performance, as reflected in increasing inventory turnover, had been so steep, and had climbed so high.

I made my new connection while thinking about Schonberger's two charts and Oliver's point that with today's rapid information flow, it is difficult to justify the existence of much inventory.

Exhibit 1-2 implies that in the companies Schonberger cites, today there is a whale of a lot less inventory relative to the cost of goods sold than there was in 1975. And, when inventories are kept low, the changes in inventory are also going to be small, which implies that these American manufacturers are producing at close to the rate of consumption.

America's leading retailers are not far behind. Recently we have read that Wal-Mart restocks its stores every other night, versus weekly or biweekly for other discount chains. In the late Eighties, as a Nordstrom supplier, I learned that they penalized our company for either early or late shipments. Such retailers have learned not to carry extra inventory. They *buy* at the rate of consumption.

When you're operating at the rate of consumption, inventory will remain quite stable. So long as inventory is not allowed to change, production will grow with demand, which in turn will grow with increases in population, productivity and employment. The economy can thus grow steadily, not in feast-and-famine cycles. So long as information flows instantaneously from markets to manufacturers so that large inventories aren't needed, the wide swings in operating rates which used to result from small shifts in demand will be damped out. (Thank you, Jay Forrester, for showing us in Industrial Dynamics^{iv} how, under our old inventory and ordering policies, a 10% change in demand could bring about a 40% or 50% change in factory orders. See Exhibit 2.)

All of which brings me to venture the following:

Hypothesis: changes in inventory policy in American business explain the apparent suspension of the business cycle during the 1990s, and the steadiness of the expansion of the U. S. economy during that decade.

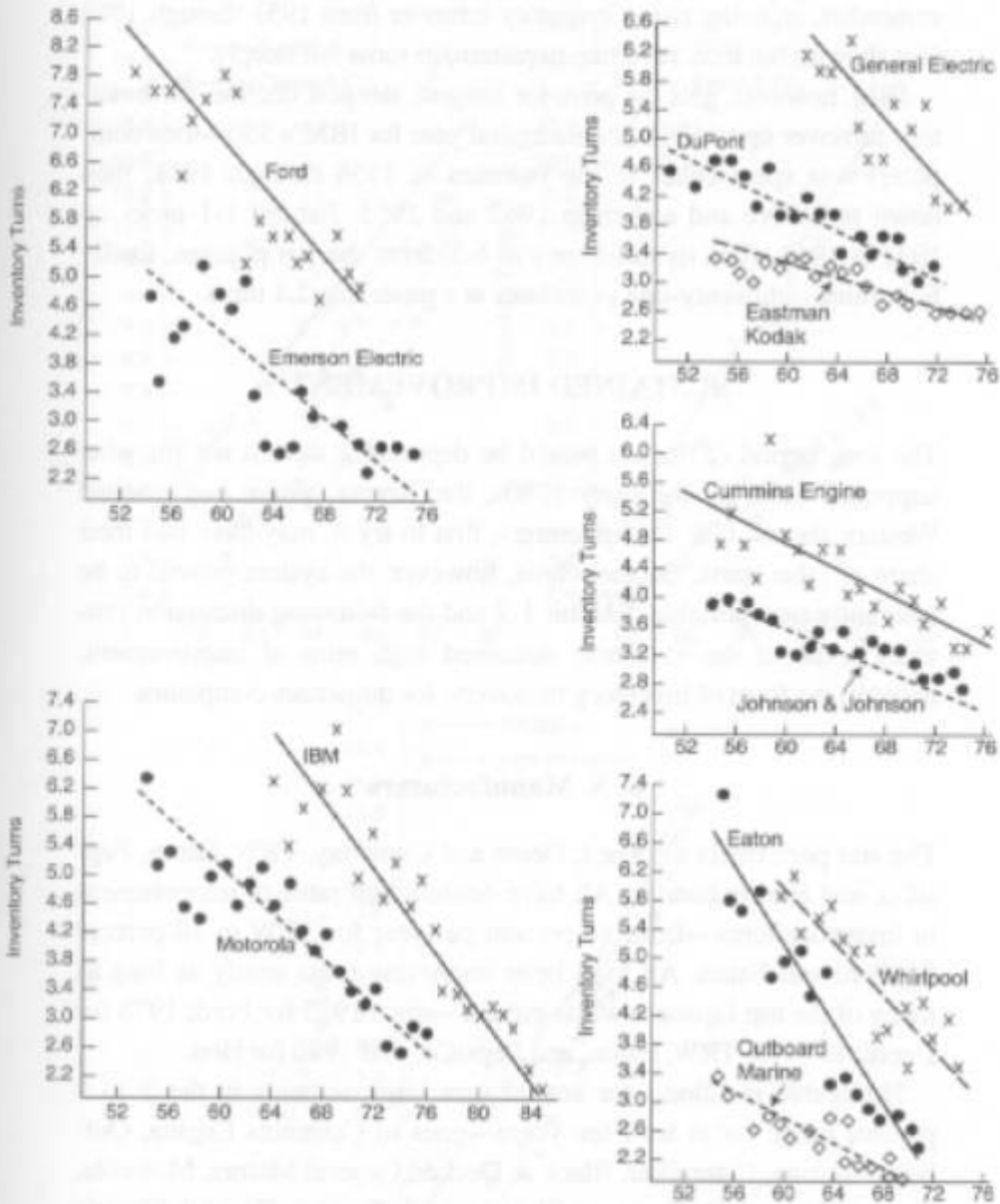
A preliminary inspection of data from the 1999 Economic Report of the President suggests that inventory turnover (measured as sales/inventory) for the whole manufacturing sector in the U. S. has, in fact, been on a pretty steady climb since 1982 (Exhibit 3). A fundamental change in the manufacturing sector's inventory policy does seem to have occurred, just a few years after Schonberger showed it to have occurred in several leading corporations.

If my hypothesis is true, there are a lot of implications, among them the optimistic one that, if we can keep improving information flows and keep reducing inventories, prosperity can continue to grow for the foreseeable future. Another is that a goodly portion of the credit for our steady economic expansion should go to America's operations people and systems developers. It was their hard work in developing and applying modern information technology in the everyday world that made the potential improvements real. But before my hypothesis can be tested, there's a lot more data to be examined, and I will gladly accept help. Just to tease my colleagues in the business schools with the probability that there is something to discover here, I offer Exhibit 4. Please do not miss that exhibit. The conclusion implied by Exhibit 4 is that we are in a whole new era with respect to inventory management in American Manufacturing. My hypothesis is that this fact has been important to the national economics of the Nineties.

[If you have suggestions or comments, please let me know: <mailto:duncanm@mail.plymouth.edu>.]

EXHIBIT 1-1

Sample Inventory Turns, 1950-75*

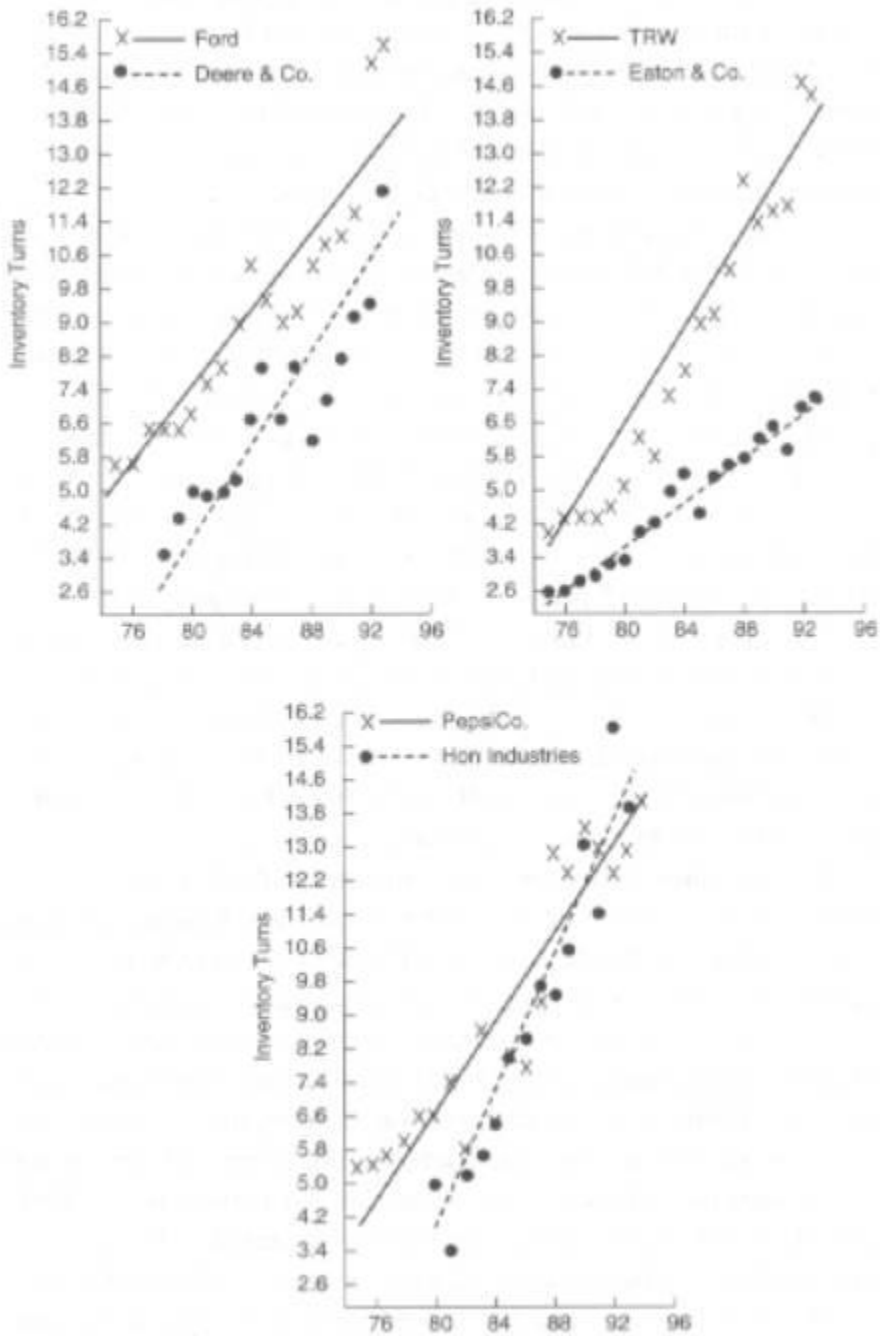


*Most data for Exhibits 1-1 and 1-2 come from the Compustat database, which does not include the years 1950-53.

Graphs were first published in Richard J. Schonberger, "The World Class Manufacturing Company—Ten Years Later," a seminar notebook (Management Research Corp., Spring 1995), pp. 36-37.

Source of exhibits 1-1 and 1-2: Schonberger, Richard. World Class Manufacturing: the Next Decade. The Free Press, New York, 1996, p. 3 ff.

EXHIBIT 1-2
Sample Inventory Turns 1975-95

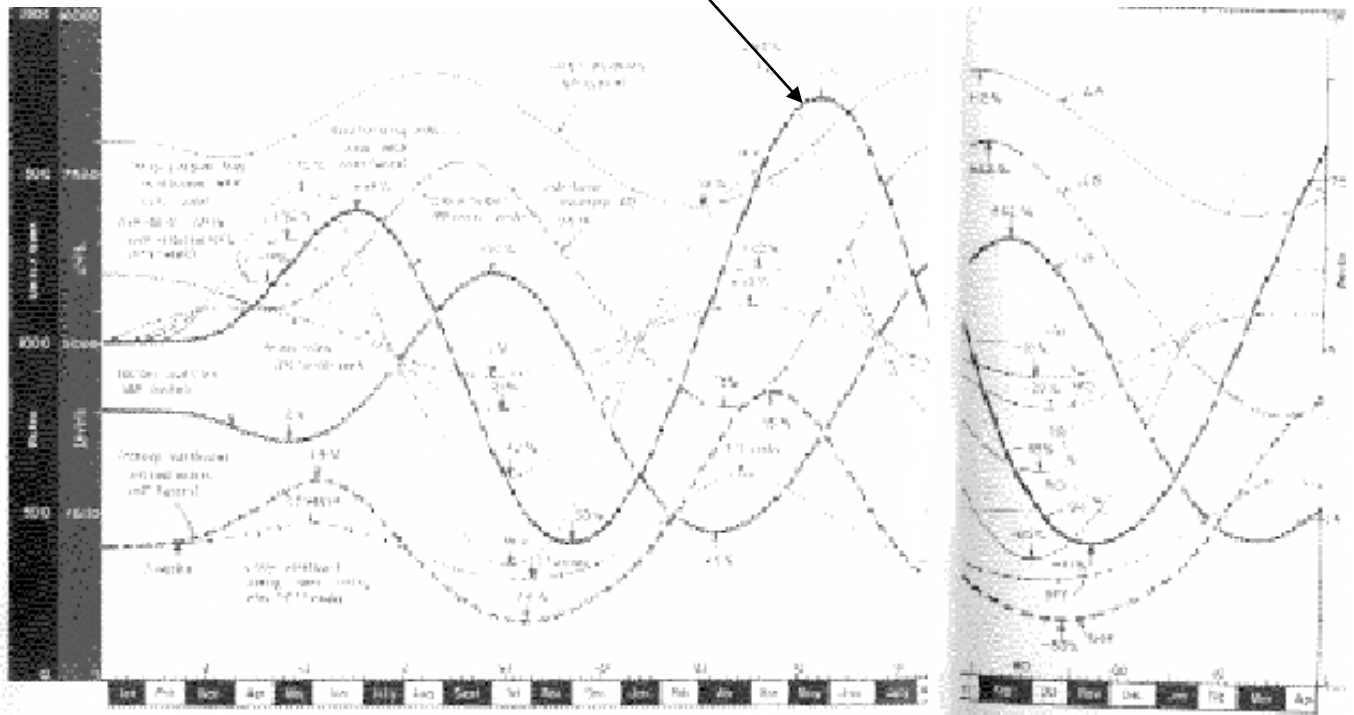


Source of exhibits 1-1 and 1-2: Schonberger, Richard. World Class Manufacturing: the Next Decade. The Free Press, New York, 1996, p. 3 ff.

Exhibit 2

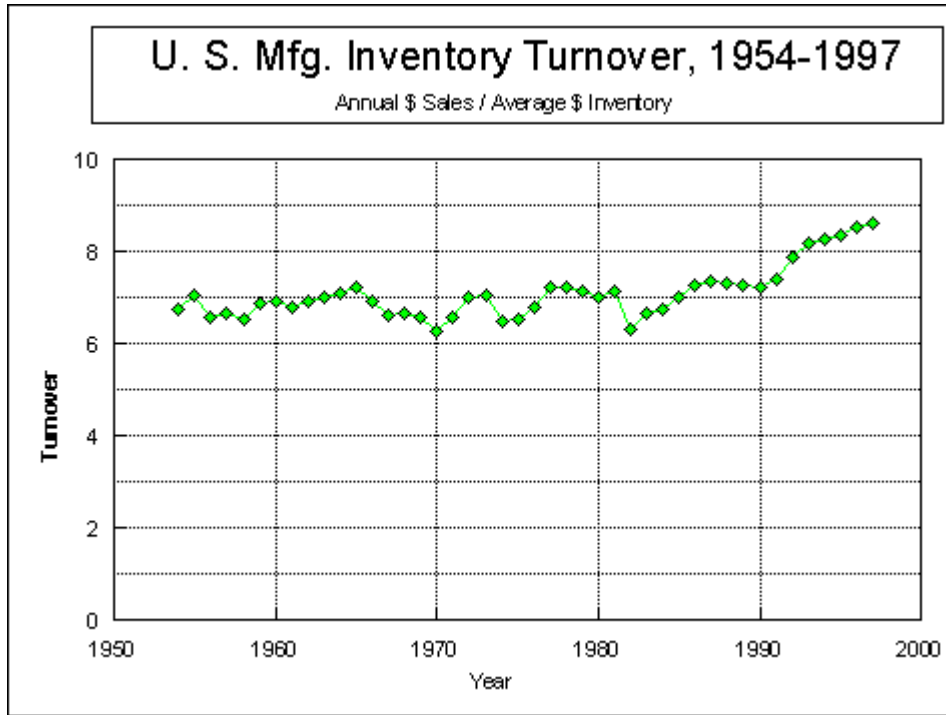
The Effect on Factory Orders of Swings of +/-10% from Average Demand

In Forrester's Industrial Dynamics model as depicted below, the modest oscillations of consumer demand are represented by the dotted line of sinusoidal form which varies over time, upward to *average demand plus 10%*, then back down to *average demand less 10%*. In a system containing a consumer, a retailer, a wholesale warehouse and a factory, using at each level the accepted inventory control methods of the time (Economic Order Quantity and Re-Order Point logic, or EOQ/ROP), Forrester showed that the factory orders driven by that modest oscillation in end demand would vary in the manner shown by the **Factory Orders** line, from over 40% above average demand to some 50% below average demand, as stocks were first increased within the supply chain, then worked back down. When enough industries' "down cycles" coincided, we suggest, a recession would result.



Source: Forrester, Jay: Industrial Dynamics [MIT Press, 1961]. (Annotation added.)

Exhibit 3



Data source: Economic Report of the President, 1999 ----- H. Doc. 106-002, Page 392.

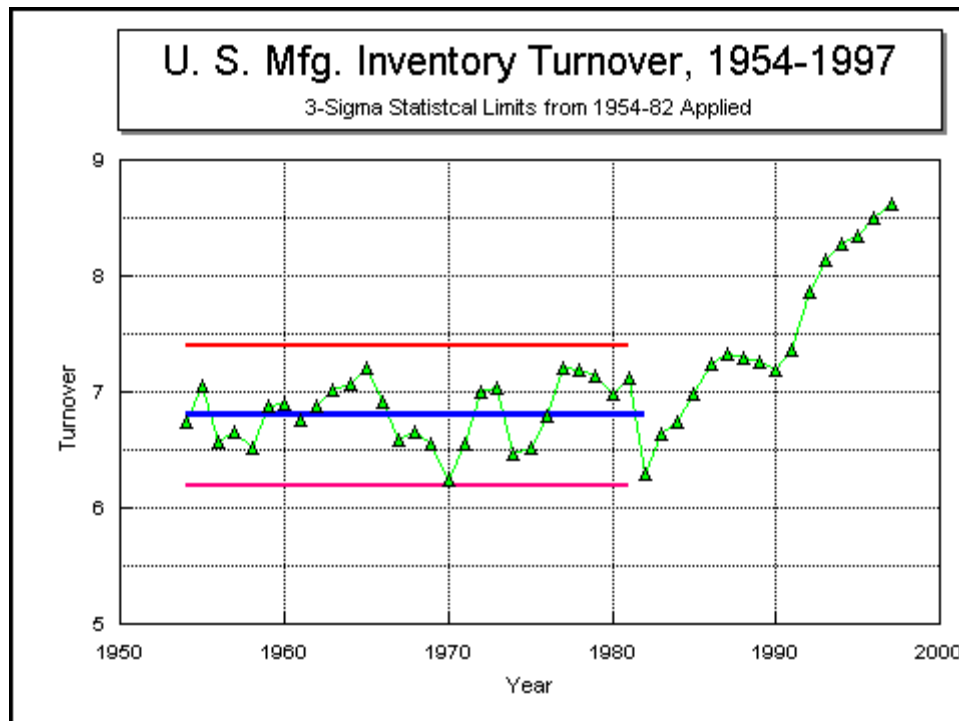
Note: The source page gives the average monthly sales and the average monthly inventory balances for U.S. manufacturers by year. The data plotted in the chart above have been computed by annualizing the monthly sales figures (multiplying by 12) and dividing by the inventory figure given for the corresponding year. The result is a proxy for inventory turnover, using Sales/Inventory, rather than the more precise Cost of Goods Sold/Inventory. Unless Gross Margins (Sales-Cost of Goods Sold) of U.S. manufacturers can be shown to have increased materially as a percentage of sales, and quite steadily so since 1982, the chosen proxy should be a useful one, overstated in a consistent manner. Hence, for the purposes of this hypothetical paper, the author uses the proxy.

Exhibit 4

Nine Sigma Above the Mean?^v

Interpreting:

1. The mean Turnover (Sales/Inventory) of U.S. Manufacturers between 1954 and 1982 was 6.81. The system generating the data (the manufacturing industries of the U.S., as reported in the Economic Report of the President), though erratic, remained within three-sigma limits during that period (Upper Control Limit = 7.41, Lower Control Limit = 6.20).
2. Sometime after 1982, the data-generating system changed in some fundamental way. Turnover (Sales/Inventory) began a steady climb, which, after a brief respite during the recession of 1988-90, has continued.
3. Relative to the parameters within which the system of 1954-82 was operating, the 1997 Turnover ratio of 8.61 is 8.98 Sigma above the mean. The probability of being *six sigma* above the mean from random causes is under 2 per million. America's manufacturers have been *above* the six sigma level (8.01) in every year since 1993.
4. The conclusion must be that we are in a whole new world with respect to inventory management in American Manufacturing. The author's hypothesis is that this fact has been important to the national economics of the Nineties.



Endnotes:

ⁱ Oliver, Richard W., "The End of Inventory?", Journal of Business Strategy, Jan-Feb. 1999, p.10.

ⁱⁱ TIME, February 15, 1999. Cover article.

ⁱⁱⁱ Schonberger, Richard. World Class Manufacturing: the Next Decade. The Free Press, New York, 1996, p. 3 ff.

^{iv} Forrester, Jay. Industrial Dynamics, MIT Press, Cambridge, Massachusetts, 1961.

^v In calculating control limits for the time series (Run Chart) shown here, the author employed the "SPC EXpert" software package by Quality Software Designs, Inc., 933 East Stroop Road, Kettering, OH 45429. Charts were done in Lotus 1-2-3.