Workstations and High-Performance Systems

Bulletin

* DRAFT * Price Elasticity in High-Performance Computers (HPC)

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IDC Opinion

Prices in the high-performance computing (HPC) market exhibit very different trends in the different market segments.

High-end capability systems have a price elasticity of 1.0 to 3.0, while vector supercomputers are price inelastic with price elasticity similar to luxury items, while capacity systems have a consistently higher price elasticity.

Capacity systems continue have price elasticity considerably greater than unity showing that demand is increasing at a faster rate than price reductions. Demand will continue to outpace price reductions as new uses continue to be found for capacity HPC systems.

Business pressures will drive producers out of market segments with low growth and low price elasticity. This means that it will continue to be hard to find producers willing to build custom capability computers and most vendors will move even further towards a leveraged product strategy of using high volume based products to serve capability customer needs.

This is the fourth bulletin in a series that investigates prices and price/performance of technical HPC computers. In this bulletin the effect of changes in system prices is explored to determine the impact on overall market demand.

Microeconomics and Price Elasticity

Price elasticity (Ed) represents the relative correlation of price (P) on the units sold (Qd) in a given time period. For this analysis prices are in US dollars, and units are in computer systems shipped per year. The data used in this investigation are from IDC HPC market census data. Table 1 shows the effects of different price elasticity levels. Note that price elasticity is often constant only over a narrow range of prices, this analysis focuses on actual HPC price levels over the last 6 years.

Table 1

Typical Price/Demand Relationships

Price Changes	Sales/Demand Changes				
	Major Decrease	**Minor Decline**	**Stable**	**Minor Increase**	**Major Increase**
Major Increases	Ed is close to 1 (unity)	In elastic Ed is in< 1	Very Inelastic Ed close to zero	Very rare*	Very rare*
Minor Increases	Very elastic Ed is > 1	Ed is close to 1 (unity)	Very Inelastic Ed close to zero	Very rare*	Very rare*
Stable	Dead market or product**	Dead market or product**	Ed is close to 1 (unity) or Very Inelastic Ed = 0	Very rare*	Very rare*
Minor Decline	Dead market or product**	Dead market or product**	Very Inelastic Ed close to zero	Ed is close to 1 (unity)	Very elastic Ed is > 1
Major Decrease	Dead market or product**	Dead market or product**	Very Inelastic Ed close to zero	Inelastic Ed < 1	Ed is close to 1 (unity)

It is very rare to have increased prices cause increased demand.

** Represents a dead product or dead market where sales continue to fall regardless of price reductions. No one wants to buy more regardless of price.

Price Elasticity = Ed = %ΔQd / %ΔP

For example: If Ed = -.5 it tells us that for every 1% change in price, the quantity demanded (Qd) will change .5% in the opposite direction.

Note: The negative sign is usually dropped since when prices go up, quantities goes down. If Ed is greater than 1, the demand curve is

*price **elastic**, if less than 1 it is **inelastic**, if it is equal to 1, it is called **unitary** demand.*

Table 2

Examples of Non-Computer Price Elasticity Levels

Product Category	Ed
Gasoline	0.20
All food products	0.24
Beef food products	0.64
Non-food retail products	1.02
DRAM memory chips	1.50
Electricity (Generated)	2.20

Examples of price elasticity values are shown in Table 2. Products like gasoline and food are very inelastic, because even large changes in prices don't have a major impact in the amount purchased (at least in the short term). However specific foods will have more elasticity -- if the price of beef goes up some consumers can switch to chicken or pork. It is interesting that both DRAMs and electricity have price elasticity values greater than unity because demand (or sales) increase faster than prices have declined. Price elasticity is sometimes only a constant value for a narrow range of prices. The values in Table 2 have been constant over a wide range of prices and a long time period.

Price Elasticity in HPC

Capability Systems Price Elasticity

Capability computers as a whole have price elasticity that has ranged from 1.0 to 3.0 over the last 6 years, although mostly near the 1.0 level. Unlike the vector supercomputer and capacity markets that have a more consistent price elasticity level over the last 6 years. Over this period prices have declined from $6,632,000 to $4,176,000 and systems sold have grown from 163 to 250 units. For every $28,000 drop in prices 1 additional system was sold. Figure 1 shows the variation in price elasticity for the capability market segment.

Figure 1

Price Elasticity for All Capability Computers

Capability Prices and Demand '94 to '00
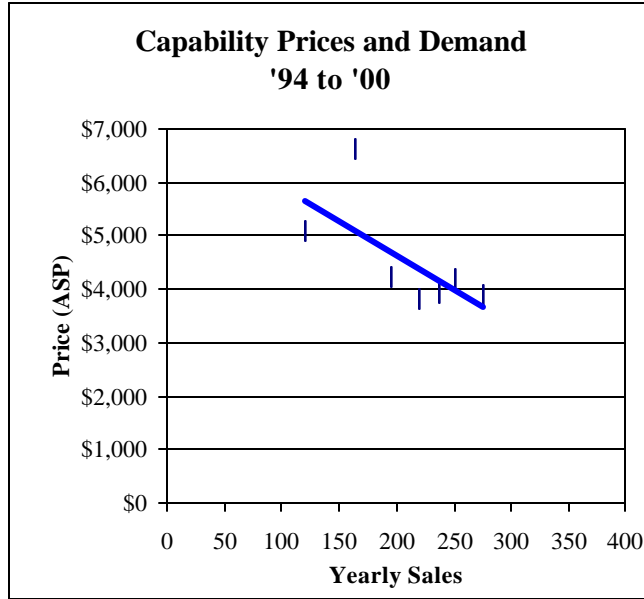
Vector Supercomputer Price Elasticity

For vector supercomputers price changes have no affect on overall market demand.

For vector supercomputers price changes have no affect on overall market demand. For individual sales, a vendor can increase its market share with a lower price offer, but lower prices have not increased unit sales of vector supercomputers. Figure 2 shows the demand curve representing sales from 1994 to 2000. The curve is almost vertical indicating that the demand for vector supercomputers is inelastic ($Ed \sim 0.0$).

Figure 2

Price Elasticity for Vector Computers
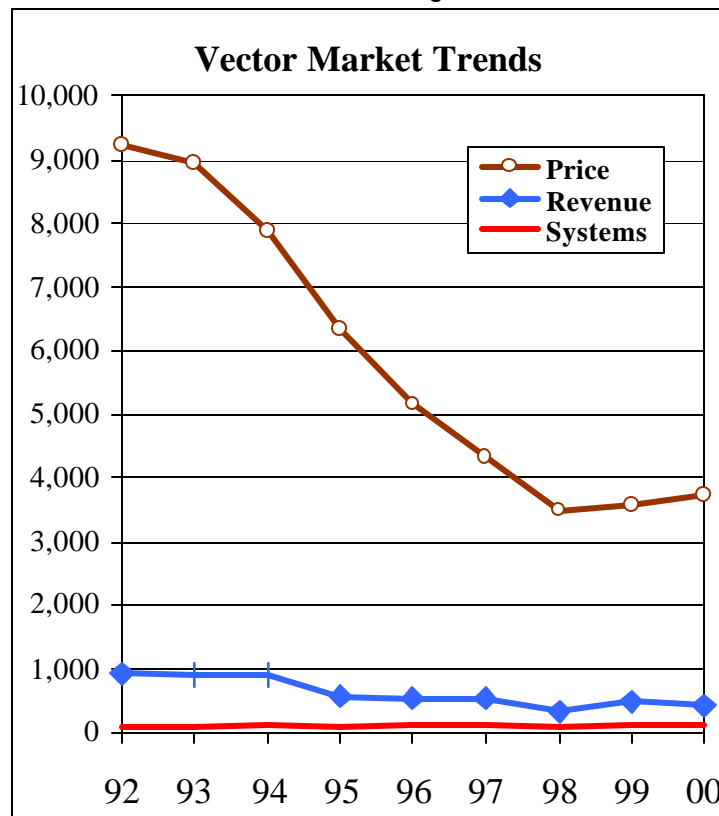
Vector Price Elasticity

A IDC
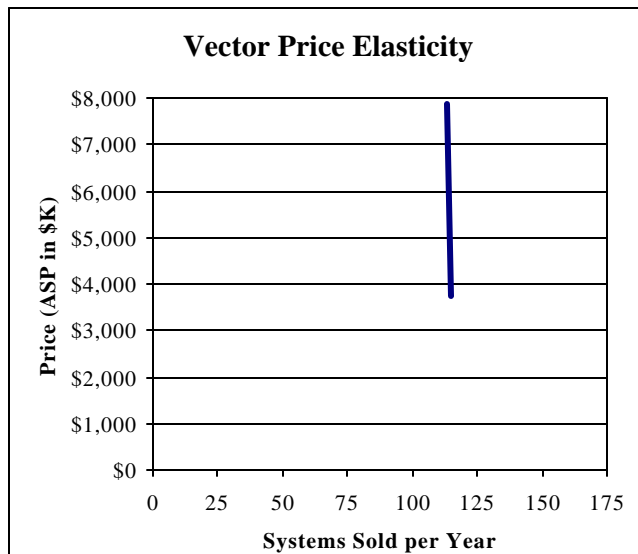
The implication is that there is a relatively fixed demand for vector supercomputers of 115 +/-20 systems per year regardless of price levels. The entire range in vector systems sold since 1992 is 97 to 130 systems per year. Table 3 shows the vector price elasticity calculations.

Table 3

Vector Supercomputer Analysis

	1994	2000	Percent Change	Ed
Systems Sold	113	115	1.754%	
Price (ASP)	$7,891	$3,722	71.80%	
Price Elasticity				0.0244

In a market with low (or zero) price elasticity, price reductions directly impact the total value sold, resulting a decline in the overall size of the market. Figure 3 shows the market revenue compared to prices and systems sold each year. Prices declined sharply, systems sold remain flat, and the market size declined from $914 million in 1992 to $428 million in 2000.

Figure 3

Vector Market Changes Over Time

Capacity Systems Price Elasticity

The larger capacity market reacts to prices in a very consistent price elastic manor as shown in Figure 4. Price elasticity was 3.375 over the period from 1995 to 2000. There are many other forces that impact market demand in addition to price levels. IDC started detailed analysis of the capacity market in 1995. In the capacity segment prices have fallen from $110,000 per system in 1995 to $78,000 per system in 2000, while system sales has grown from 19,477 in 1995 to 71,292 in 2000. So for every drop in system price of $1,000 1,619 additional systems where sold.

Capacity computers have a price elasticity considerably greater than unity and are similar to DRAMs because dropping prices are exceeded by the increase in usage of these products.

Figure 4

Price Elasticity for All Capacity Computers

Capacity Prices and Demand '95 to '00
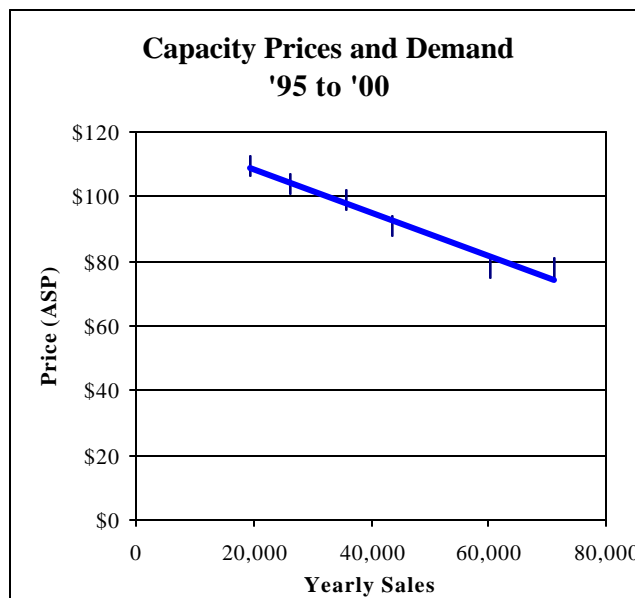
IDC Analysis

The strong price competition in HPC over the last few years has resulted in very different market impacts as shown in Table 5:

1. A collapse of the vector supercomputer market.

2. An ignition of growth of system sales in the capacity market. Between 1994 to 2000 the overall capability market declined by -3%, while the overall capacity market grew by 577%.

3. The capability market as a whole stayed flat at around $1 billion a year and has a price elasticity that varies from 1.0 to 3.0.

Capacity systems continue to have price elasticity considerably greater than unity showing that demand is increasing at a faster rate than price reductions. Demand will continue to outpace price

reductions as new uses and applications continue to be found for capacity HPC systems.

Vector supercomputers have price elasticity similar to luxury items, while capacity systems have more typical price elasticity. Price reductions in the vector supercomputer market has cut market revenues in half, while yearly system sales remain constant.

Table 5

Price Elasticity by Market Segment

Segment	Price Elasticity
All Capability Computers	1.0 to 3.0
Vector Supercomputers	0
All Capacity Computers	Consistently above 3.0

Business pressures to produce growing revenues, profits and leverage R&D expenses will drive producers out of market segments with low growth and low price elasticity. This means that it will continue to be hard to find producers willing to build custom capability computers and most vendors will move even further towards a leverage product strategy of using high volume based products to serve capability customer needs.

Implications to Vendors

Aggressive price reductions in the capability market segment, and especially in the vector segment can help win individual sales, but reduces the overall market revenues. Whereas price reductions in the capacity market segment generates growth in demand and growth in overall market size.

Focusing resources on markets that are growing and with higher price elasticity values provide the highest potential. Markets with low price elasticity and competitive price pressures are to be avoided.

Implications to HPC Users

Expect that there will be continued improvements in pricing in the capacity segment and a slowing in system price reductions in the vector supercomputer segment.

Expect that capability systems will be based more on leveraged product strategies and will contain less custom features over time.

Needless to say, as markets continue to evolve, those with growth and size will flourish and those without growth will decay. Thus vendors will continue focusing their R&D on growth markets and away from declining markets.