**TECHNOLOGY RESEARCH**

NETWORKING INDUSTRY

Does Valuation Matter?

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- Notwithstanding the fascination of Wall Street with EPS growth rates, there is neither a statistical relationship nor a common sensible relationship between EPS growth rates and stock prices, in our opinion.

- Indeed, in our view, any metric that does not take into account risk and capital needs and that fails to accurately capture the true economic returns generated by a business cannot have significant predictive power for purposes of market valuations.

- Return on invested capital addresses all of these issues. To the extent shareholders reward companies for profitable growth, we would expect to see a strong positive correlation between a company's return on invested capital and its valuation.

EV/IC VERSUS ROIC ■ *Gorillas (6/2/97)*

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$$R^2 = 0.9527$$
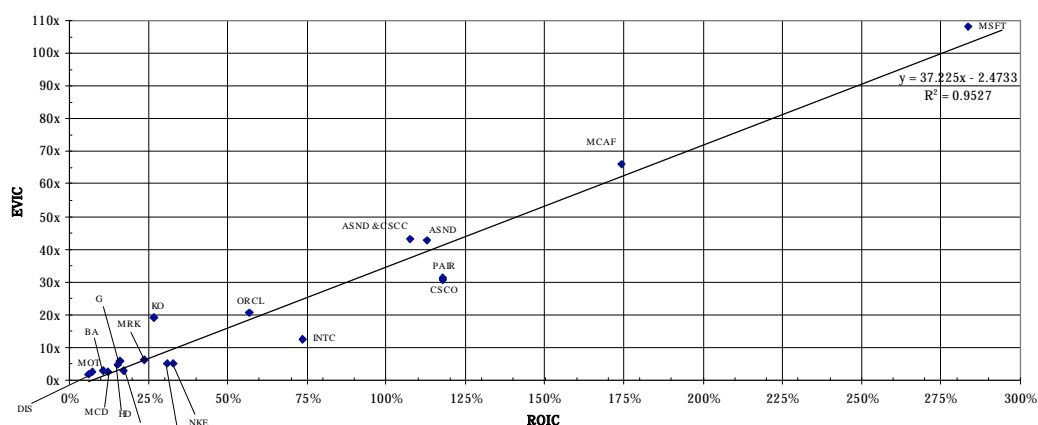
NETWORKING INDUSTRY EVIC/ROIC ■ *(1/94–5/97)*
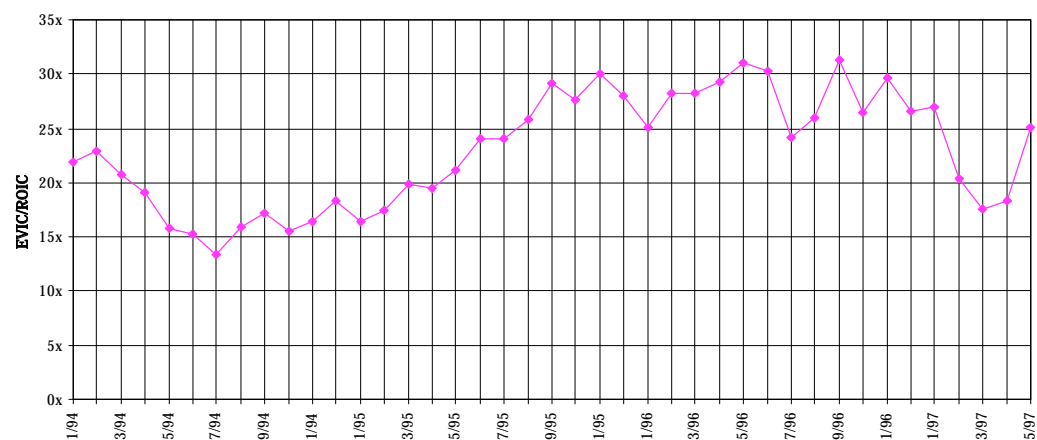
Source: Robertson, Stephens & Company.

The Goal of Securities Analysis (How We Earn Our Keep)

> "Leaving the question of price aside, ==the best business to own is one that over an extended period can employ large amounts of incremental capital at very high rates of return.== The worst business to own is one that must, or will, do the opposite—that is, consistently employ ever-greater amounts of capital at very low rates of return. Unfortunately, the first type of business is very hard to find . . ."

> "Your goal as an investor should simply be to purchase, at a rational price, a part interest in an easily understandable business whose earnings are virtually certain to be materially higher five, ten and twenty years from now."

The above observations were made by Warren Buffett in his Chairman's Letter to Shareholders of Berkshire Hathaway Inc. in Berkshire's respective 1992 and 1996 Annual Report to Shareholders. We note the emphasis of Mr. Buffett's observations. First, "leaving the question of price aside," the principal focus of any investor having an intermediate to long-term investment horizon should be on identifying and purchasing equity interests in companies that can sustain long-term profitable growth. In short, an investor should focus on the fundamentals of the business, not on the vagaries of the market. Second, by the way, such interest should be purchased at a rational price. Thus, in response to the query posed in the title of this research report, we believe the question of valuation has the most significance in assessing what is a "rational price."

Stated in a somewhat more scientific manner, valuation is important for the following reasons:

- The goal of securities analysis is to identify securities having market prices that differ from their fair price (i.e., intrinsic value).

- Any discussion of "fair price" requires the concept of "fairly priced."

- The concept "fairly priced" implicates a valuation model.

Market Myths (Do You Believe in the Tooth Fairy?)

We note that the vast majority of market participants believe that valuation is the holy grail of investing. The following "myths" regarding valuation are widespread throughout the investment community:[1]

- Valuation is quantitative; valuation is objective.

- Well-researched and well-done valuation is timeless.

- Good valuation provides a precise estimate.

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[1] See *Damodaran On Valuation Security Analysis for Investment and Corporate Finance*, Aswath Damodaran (John Wiley & Sons, Inc., 1994).

- The more quantitative the valuation, the better.
- The market is generally wrong (i.e., inefficient).
- The product, not the process, of valuation matters.

We also note that "The vast majority of market participants attempt to understand valuation and subsequent stock price changes using an accounting-based formula, which generally defines value as a price-earnings multiple times earnings."[2] Variations of this formula include the following: relative P/E, EPS momentum, absolute P/E and P/E versus growth rate. Serving as both a proxy for cash flow and a basis for executive compensation and incentive plans, each of these formulas has the virtues of simplicity, wide acceptance and broad articulation. Notwithstanding their superficial appeal, as we set forth in a previously published research note regarding Return On Invested Capital (ROIC), accounting-based metrics are fundamentally flawed valuation tools by virtue of the following:[3]

- Their failure to address what we believe should be an investor's principal focus over the intermediate- to long-term investment horizon, namely, value creation—how much economic value has been and will be created from the funds invested in and deployed by a company;
- Their ability to be manipulated;
- Their inability to distinguish between operating and financing decisions; and
- Their failure to take into account risk, capital requirements and the time value of money.

For these reasons and as more fully explained in our previous ROIC research note, we believe that myopic focus on GAAP-based earnings, earnings growth and derivative metrics, including P/E ratios and enterprise value/EBITDA, can result in misleading conclusions and, at best, convey insufficient information regarding the true economic vitality of a company's current and prospective operations.

ROIC

In place of such GAAP-based metrics, in our earlier ROIC research note, we stated our belief that over an intermediate- to long-term investment horizon, an investor's primary focus should be value creation—how much economic value has been and will be created from the funds invested in and deployed by a company—and that Return On Invested Capital (ROIC) is a superior quantitative touchstone with which to assess value creation.

ROIC measures the amount of cash generated by each dollar of capital invested in a company's operations. Alternatively stated, ROIC measures how effectively a

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[2] See "Frontiers of Finance: Competitive Advantage Period 'CAP' The Neglected Value Driver," dated January 14, 1997, Credit Suisse First Boston Equity Research, authored by Michael Mauboussin, a managing director and an equity analyst covering the food industry at Credit Suisse First Boston, and Paul Johnson, CFA, a managing director and equity analyst at Robertson Stephens and Company.

[3] We refer to "NETWORKING INDUSTRY A New Way to Listen to the Music: ROIC," Robertson Stephens & Company Institutional Research, dated December 17, 1996, authored by Paul Silverstein, Paul Johnson and Ara Mizrakjian.

company has deployed the capital invested in its business in generating cash flow. A company whose ROIC exceeds its cost of capital generates positive net cash flow, thereby creating value; a company whose ROIC is less than its cost of capital generates negative net cash flow from an economic perspective, thereby destroying value; and a company whose ROIC equals its cost of capital neither creates nor destroys value.

A company can create value by any one of the following four means:

- Reallocating or otherwise improving the use of its existing capital to increase the spread between its ROIC and its cost of capital.

- Deploying more invested capital in its current business, provided the returns generated by such capital exceed its cost.

- Investing additional capital in new projects (lying outside of the traditional scope of its business) yielding a marginal ROIC in excess of the cost of such additional capital.

- Lowering its cost of capital.

One common theme runs through each of the above value-creating strategies: in order to generate more cash flow than is consumed by its business, a company must earn a higher ROIC than its cost of capital. The ultimate size of this net cash flow to investors is driven by the following three factors:

- The size of the spread between a company's ROIC and its cost of capital.

- The length of time such spread persists (what we refer to as Competitive Advantage Period or "CAP").[4]

- The amount of capital that can be invested at such spread.

The ideal value-creating company is one that has an ROIC that far exceeds its cost of capital and that has an unlimited number of investment opportunities, each of which will yield an ROIC greater than the cost of the capital required for such investment. The larger the positive spread, the longer it can be sustained by the company, and the more capital that can be invested in the company's business, the greater will be the net positive cash flow generated by the company.

While the positive spread between each investment's ROIC and corresponding cost of capital ideally should be equal to or greater than the spread between the company's current ROIC and cost of capital, each investment will create value as long as its spread is positive, regardless of the size of the spread. If a company's cost of capital exceeds its ROIC from current and prospective investment projects, however, any growth will transfer value from the company's investors to its customers, suppliers, management and/or employees.

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[4] "CAP" refers to Competitive Advantage Period, which is the time period during which a company is expected to generate returns on incremental invested capital that exceed the cost of such capital. The term "CAP" was first introduced by Michael Mauboussin and Paul Johnson in "Competitive Advantage Period 'CAP' The Neglected Value Driver".

In the long run, in order to sustain extraordinary (i.e., above average) ROIC, a company must create or compete in an industry that has high barriers to entry. In the absence of entry barriers (including economies of scale), a high level of ROIC within an industry will lead existing competitors to increase the amount of capital invested in their operations in an effort to grow their businesses and reap additional correspondingly high returns. In addition, high ROIC will attract into the industry new entrants seeking to capture a portion of these extraordinary returns.

In the absence of barriers to entry, the amount of capital attracted to an industry will be roughly proportional to the level of ROIC generated by the industry—the higher the industrywide ROIC, the more capital will be attracted to the industry. Inevitably, once the pace of investment surpasses the industry demand growth rate, ROIC for the industry will begin to decline as the rate of increase in net additional investment overtakes the rate of increase in net cash flow generated by such additional investment.

P/E to Growth Rate

One of the most commonly used GAAP-based investment metrics is the forecast of a company's P/E multiple based on its EPS growth rate. In addition to the shortcomings noted above, we believe this valuation model suffers from its focus on EPS growth without any inquiry as to the nature of such growth. From an investors' perspective, as observed by Mr. Buffett, not all EPS growth is to be desired. EPS growth that is manufactured by deploying large amounts of invested capital that generate low rates of return does not contribute to shareholder wealth and worse, actually destroys value when such returns are below the cost of capital. Such EPS growth stands in stark contrast to EPS growth that is generated by increasing the returns generated by a company's existing invested capital or by deploying additional invested capital at increasing marginal returns. As further noted by Mr. Buffett in his Berkshire Hathaway 1992 Annual Report:

> "Growth benefits investors only when the business in point can invest at incremental returns that are enticing—in other words, only when each dollar used to finance the growth creates over a dollar of long-term market value. In the case of a low-return business requiring incremental funds, growth hurts the investor."

The following example serves to illustrate this point. Companies A and B both compete in the same industry, trade at the same stock price, have the same number of outstanding shares and each earned $1 in 1995. Company A, however, only required $10 of capital to produce its $1 of earnings, while Company B required $20 of capital. Carrying through our example and further highlighting the inadequacy of earnings and earnings growth as investment guideposts, both companies doubled their earnings to $2 in 1996. Company A, however, only required $5 of additional capital to produce its additional $1 of earnings, while Company B required $25 of additional capital to produce its additional $1 of earnings. Analyzing these companies on the basis of earnings and earnings growth, an investor would be indifferent between them—both companies generate the same amount of earnings and the same earnings growth rate.

However, as investments the two companies are far from equivalent, as clearly reflected by analyzing each company's respective ROIC. Company A increased its ROIC from 10% in 1995 to 13.33% in 1996 and generated a marginal ROIC of 20% on each dollar of additional capital invested in its business in 1996. In contrast, starting with a lower ROIC, 5%, than Company A in 1995, Company B proceeded to further widen its profitability gap with Company A by generating only a 4% marginal ROIC on each dollar of additional capital invested in its business in 1996, which resulted in an ROIC of 4.33% in 1996. This 4% marginal ROIC fell short of both Company B's historic 1995 ROIC and Company A's 1996 marginal ROIC. Company A thus generated twice as much value as Company B in 1995, slightly more than three times as much value in 1996 and five times as much value on each dollar of additional new capital invested in 1996.

To test our convictions, in Figure 1, we have plotted a regression for one of the most commonly used GAAP earnings-based metrics, P/E multiples as a function of EPS growth rates, for each of the companies that we follow in the data networking industry. Specifically, we have plotted regressions of P/E multiples on both historic EPS growth rates and projected EPS growth rates using analysts' consensus estimates for 1997 and 1998 (see Figure 1). As evidenced in the figure, the current regression of P/E ratios on historic 1996 growth rates yields an R^2 of 0.61, which leaves 39% of the movement in the sampled companies' stock prices unexplained. The regressions of P/E ratios on analysts' consensus projected 1997 and 1998 EPS growth rates yield relatively weak R^2s of 0.3629 and 0.0184, respectively. Even worse, the regression of P/E ratios on projected EPS growth rates shows a negative correlation between P/E ratios and projected EPS growth rates. Further attenuating any argument for a causal relationship between P/E ratios and earnings growth rates—and thus, for using growth rates to project or to explain stock prices—historically all three regressions (i.e., based on EPS growth for the past year and projected EPS growth for the current and following years) have ranged between 0 and 0.25.[5]

We conclude that notwithstanding the fascination of Wall Street (including many of our fellow analysts) with EPS growth rates, there is neither a statistical relationship nor a common sensible relationship between EPS growth rates and stock prices. Indeed, we believe any metric that does not take into account risk and capital needs and that fails to accurately capture the true economic returns generated by a business cannot have significant predictive power for purposes of market valuations.

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[5] Regression analysis is used to determine the specific relationship between two (or more) variables from empirical observations. The coefficient of determination, R^2, measures the goodness of fit of a regression relationship. R^2 is defined as the percentage of the total variation in the dependent variable (here, P/E ratios) that is explained by changes in the independent variable (EPS growth rates). Thus, an R^2 of 0.62 means that the regression equation explains 62% of the variation in the percent change in P/E ratios. It should be noted that regression does not necessarily prove causation; rather, it only shows association, or correlation, between the variables. The significance of this distinction is highlighted by the results of the regression of P/E ratios on EPS growth rates. Clearly, as evidenced by their negative correlation coefficient, there is no direct causal relationship between P/E ratios and EPS growth rates, and the regression is thus meaningless.

Return on invested capital addresses all of these issues. As noted above, we believe that (1) the ability of a business to invest its capital at enticing incremental returns is the key driver to creating long-term market value and (2) ROIC is a superior metric with which to assess value creation and concomitantly is a more accurate measure of the economic fundamentals of a company's business than GAAP-based earnings metrics.

EVIC/ROIC Valuation Model

If the above two points are valid, ROIC should be a significant driver of a company's valuation. To the extent shareholders reward companies for profitable growth, we would thus expect to see a strong positive correlation between a company's return on invested capital and its valuation.

More precisely, we would expect to see a strong correlation between a company's ROIC and its enterprise value divided by its invested capital. Why do we frame "valuation" in terms of enterprise value divided by invested capital? This latter measure (which, for convenience, we will refer to as EV/IC) is our version of a Price to Book Value ratio, with enterprise value substituted for market price and invested capital replacing GAAP-based book value in the denominator of the metric. We use the EV/IC metric for the simple reason that we believe it to be a more economically correct gauge of value creation than the traditional accounting-based formula.[6] This measure provides us with the value or multiple being assigned by investors to each dollar of capital invested in a company.

Because ROIC measures the returns generated by each dollar of a company's invested capital and EV/IC measures the multiple assigned by investors to each such dollar of invested capital, we would expect to see a strong positive correlation between these two measures. Alternatively stated, we believe that, all other things being equal, the market assigns a higher EV/IC multiple to a company with a higher ROIC than to a peer company with a lower ROIC and visa versa.

We have set forth in Figures 2–7 two series of tables plotting (1) returns on invested capital, or ROIC (i.e., NOPAT divided by invested capital), on the x-axis, relative to (2) enterprise value divided by the invested capital deployed in their businesses, on the y-axis, for each of the networking companies that we follow with a number of different groups of "peer" companies. The first series of tables is based on closing market prices on April 25, 1997—the date representing the approximate nadir for most of the data networking stocks—and invested capital as of the end of calendar Q4 1996 or (for those companies having released their financial results prior to April 25, 1997) Q1 1997. The second series of tables is based on closing market prices on June 2, 1997, at which time most of the data networking stocks had rebounded significantly off of their recent lows, and on invested capital as of the end of calendar Q1 1997.

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[6] Invested capital measures all cash invested and deployed in the operating business of a company since its inception. Enterprise value equals market value plus debt less excess cash.

We have further plotted the regression line for each of these groups of data points to indicate the "goodness of fit" of our data—i.e., the strength of the correlation between the ROIC metric and the multiple assigned by investors to each dollar of capital invested in an enterprise. If ROIC does in fact drive this multiple, one would expect to see the regression equation yield a high R^2—i.e., the closer the regression is to one, the more predictive power we can ascribe to ROIC as a determinant of enterprise value divided by invested capital (as noted above, alternatively stated, this latter measure is simply the multiple assigned by the market to each dollar of capital invested by an enterprise in its business).[7]

Moreover, in an effort to rigorously test its consistency, we have tested the regression of EV/IC on ROIC under each of the following scenarios:

- Intra-industry: Among a wide range of companies in the data networking industry (see Figure 2).

- Cross-sectionally across industries: Among a wide range of companies both within and outside of the data networking industry (see Figure 3).

- Among companies having similar profitability and growth rates, both (1) intra-industry within the data networking industry (see Figures 5 and 7) and (2) cross-sectionally, both within and outside of the data networking industry (see Figures 4 and 6).

- Longitudinally: across time for each of the above scenarios (see Figures 2–7).

We have set forth the R^2 value for each regression in the top right-hand corner of each of the tables, along with the regression equation.

In particular, we have plotted the regression of EV/IC on ROIC for the following groups of companies:

Figure 2: The 12 networking companies that we follow plus 4 other leading networking vendors.

Figure 3: All 16 networking vendors from Figure 2, plus all 14 of the non-networking industry gorillas noted below in Figure 4, plus another 16 leading technology vendors.

Figures 4–7 subdivide the companies in Figures 2 and 3 into three different groupings (or what we refer to as cohorts) of companies that exhibit, in our estimation, highly similar traits. These cohorts are as follows: gorillas, chimpanzees and emerging companies.

Figure 4: Cisco, Ascend, PairGain and 14 other non-networking industry companies that we refer to as "gorillas." As the name suggests, this group comprises companies that dominate their respective industries or particular market segments. These companies are characterized by a number of monopolistic traits, including dominant market shares and extraordinary profitability. Cisco is the gorilla of the networking

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[7] See Note 5.

industry. Ascend is also a networking gorilla, in our opinion, by virtue of its dominance of the remote access segment of the industry and its emerging position in the WAN segment following its announcement of a merger with Cascade. We believe PairGain to be a gorilla within the DSL market space. While Figure 2 seeks to provide a means of comparing market valuations and investors' expectations for Cisco, Ascend and PairGain to other networking vendors, Figure 4 seeks to compare them to other non-networking "gorilla" companies. We believe that in addition to Cisco, Ascend and PairGain, each of the following companies qualifies as a gorilla: Microsoft, Intel, Oracle, Hewlett-Packard, Motorola, MacAfee, The Coca-Cola Company, Gillette, Nike, Wal-Mart, Home Depot, McDonalds, Boeing and Merck.

Figure 5: Nine networking companies that we follow and identify as "chimpanzees"; we believe that these companies, while not market-dominant leaders, are characterized by "gorilla envy" and (sporadically) high profitability. They include Bay, Cabletron, 3Com, U.S. Robotics, FORE, Newbridge Networks, Shiva and ODS Networks. The ninth company is the projected combined 3Com-U.S. Robotics post-merger entity.

Figure 6: The nine networking vendors from Figure 5 plus seven other non-networking industry "high tech" companies that qualify as chimpanzees, namely: Compaq, Dell, Gateway, Micron Electronics, Computer Associates, Sybase and PictureTel. Our goal here too was to ground the networking chimpanzees with other similarly situated companies from outside the networking industry.

Figure 7: Six networking companies that we follow and identify as "emerging" vendors, including Ascend, Cascade, PairGain, Xylan and the projected combined Ascend-Cascade entity post-merger, with Netscape thrown in for good measure. These companies are characterized by high returns on invested capital or the potential to achieve high returns given their ability to dominate their particular market segments.

ROIC: Expectations and Valuations

We note that high expectations tend to facilitate a higher possibility of disappointment, while lower expectations provide more latitude for upside surprises. A company that lies above the regression line thus must deliver extraordinary returns relative to its peers if it is to sustain its extraordinary valuation. Similarly, for those companies that lie below the regression line, investors have expectations that are extraordinarily low relative to their peer companies. In our opinion, a company that lies below the regression line thus need only generate returns on its invested capital in line with its peers in order to earn a higher valuation.

This heuristic tool can be extended to analyze changes in valuation. For a company whose EV/IC to ROIC ratio lies above the regression line for its peer companies, going forward, any of the following scenarios will result in the company's EV/IC to ROIC ratio moving toward (and perhaps below) the regression line:

1. Adjustment in Investors' Expectations:

Investors lose confidence in the ability of a company to sustain its current profitability and/or rate of profitable growth—in terms of size of spread, amount of invested capital that can be applied at that spread and/or CAP—relative to its peers

or in the prospects of the industry in general. Alternatively stated, investors lose confidence in the ability of the company to continue to:

- Generate an ROIC equal to or greater than its current ROIC from its existing invested capital, or to continue to generate profitable growth with marginal ROIC equal to or greater than current (i.e., historic) ROIC;

- Maintain the growth rate of invested capital that can be invested at the current spread; and/or

- Sustain the current expected CAP.

In the case of the perception of any attenuation in the overall profitability or the rate of profitable growth for an industry in general, as we have recently seen in the data networking industry, any such change in perception tends to result in a shift in both the slope and the absolute height of the regression line as investors revalue all companies operating in the industry. The shift in the slope of the regression line can be attributable to the relatively more severe revaluation typically suffered by those companies whose valuations reflect high returns relative to their peers due to the proportionately larger gulf between investors' initial and revised expectations.

This revision in expectations manifests itself in the following forms:

- Stable ROIC attended by a decline in a company's market price relative to the market price of its peer companies prior to any change in the company's ROIC. The decline in market price will result in a proportional decline in the company's EV/IC. This scenario results in a company's EV/IC to ROIC ratio moving vertically lower.

- Stable (i.e., not increasing) market price notwithstanding the generation of profitable growth by investing capital having a marginal ROIC equal to the company's historic (i.e., current) ROIC. ROIC thus remains stable, while EV/IC declines as the denominator (invested capital) increases without any corresponding increase in enterprise value. This scenario also results in a decline in the company's EV/IC to ROIC ratio.

2. Increasing ROIC or Marginal ROIC:

If a company either generates increasing returns from its existing capital or invests incremental capital in its business that generates marginal returns that are greater than its current ROIC, even if EV/IC remains constant, the EV/IC to ROIC ratio will move horizontally to the right. Since the regression line slopes up and to the right, this shift will position the company's EV/IC to ROIC ratio closer to the regression line. Implicit in this observation is that the company's peers have not also experienced corresponding increases in their current profitability or rate of profitable growth; otherwise, the entire regression line will shift up.

Similarly, for a company whose EV/IC to ROIC ratio lies below the regression line for its peer companies, going forward, any of the following scenarios will result in the company's EV/IC to ROIC ratio moving toward (and perhaps above) the regression line:

1. Adjustment in Investors' Expectations:

Investors gain confidence either in the ability of a company to maintain or increase its current profitability and/or rate of profitable growth relative to its peers or in the prospects of the industry in general. Alternatively stated, investors gain confidence in the ability of the company to continue to generate an ROIC equal to or greater than its current ROIC from its existing invested capital, or to continue to generate profitable growth with marginal ROIC equal to or greater than current (i.e., historic) ROIC.

This revision in expectations manifests itself in the following forms:

- Stable ROIC attended by an increase in a company's market price relative to the market price of its peer companies prior to any change in the company's ROIC. The increase in market price will result in a proportional increase in the company's EV/IC. This scenario results in an increase in the company's EV/IC to ROIC ratio.

- An increase in the ROIC generated by the company attended by an even greater increase in the company's market price. EV/IC thus increases as enterprise value increases with either no increase in invested capital or a proportionately smaller increase in invested capital. This scenario results in a company's EV/IC to ROIC ratio shifting up.

2. Decreasing ROIC or Marginal ROIC

If a company either generates declining returns from its existing capital or invests incremental capital in its business that generates marginal returns that are less than its current ROIC, even if EV/IC remains constant, the EV/IC to ROIC ratio will move horizontally to the left. Since the regression line slopes up and to the right, this shift will position the company's EV/IC to ROIC ratio closer to the regression line. Implicit in this observation is that the company's peers have not also experienced corresponding declines in their current profitability or rate of profitable growth; otherwise, the entire regression line will shift down.

Proof Is in the Pudding

Well, as they say, the proof is in the pudding; we think it tastes pretty good. Consistent with this view, each of Figures 2–6 shows a very strong regression for this broad data set of networking and non-networking companies.

To recap our previous discussion, in Figure 2, we observe the correlation of ROIC to EV/IC for each of the networking vendors. Thus, this table allows us to gauge investors' expectations for a particular networking company relative to investors' expectations for such company's colleagues and competitors. This regression has typically ranged between 0.6 and 0.95 over the last nine months. The R^2 of 0.58 on

April 25 was somewhat of an outlier relative to its historical level. At June 2, the R^2 had improved to 0.68.

Figure 3 expands our perspective by anchoring this group of networking vendors to a diverse group of companies that are distinguished by their extraordinary returns and/or market perception as companies that generate (and/or have the potential to generate) extraordinary returns. This regression thus allows us to compare and ground investors' expectations for a particular networking company, as well as for the industry in general, to investors' expectations for similarly profitable companies that lie outside of the networking industry. Cash, in the form of capital, is the lifeblood of every business, public or private, irrespective of size or nature. As such, it is both a scarce and an essential resource and the one incontrovertible common denominator shared by Cisco, Ascend, Microsoft, Intel, Compaq, Coke, Gillette, Merck and, for that matter, by every business enterprise. This regression has typically ranged between 0.6 and 0.9 over the last nine months. At April 25 and June 2, the R^2 was 0.79 and 0.83, respectively.

Figures 4–7 segment this larger group into cohorts of companies that share similar traits. The individual regressions have ranged as follows:

Figure 4: Over the past six months, the R^2 for this group has ranged between approximately 0.65 and 0.99. At April 25 and June 2, these regressions yielded an R^2 of approximately 0.94 and 0.95, respectively.

Figure 5: Over the past six months, the R^2 for this group has ranged between approximately 0.65 and 0.95. At April 25 and June 2, these regressions yielded an R^2 of approximately 0.93 and 0.94, respectively.

Figure 6: Over the past six months, the R^2 for this group has ranged between approximately 0.62 and 0.98. At April 25 and June 2, these regressions yielded an R^2 of approximately 0.93 and 0.91, respectively.

Figure 7: Over the past six months, the R^2 for this group has ranged from approximately 0.65 to 0.99. Based on closing market prices on June 2, the R^2 for this group is approximately 0.49. We believe the relatively weak June 2 correlation for this group is principally attributable to investors' concerns regarding the ability of PairGain to continue to profitably grow its business for an extended period in line with the levels of profitable growth it has achieved in the recent past. Given the distance PairGain lies below the regression line, investors appear to expect returns to fall significantly below what the company achieved last quarter. Any such reversal would be against the backdrop of a steady sustained increase in ROIC over the past seven quarters from approximately 39% in the June 1995 quarter to approximately 171% in PairGain's March 1997 quarter. Bringing new meaning to the term "leveraged returns," PairGain has increased its returns generated from each dollar of capital invested in its business while substantially increasing the amount of capital generating such returns.

As is evident from their respective R^2, each of the regressions has a fairly strong goodness of fit and thus supports our contention that ROIC is a primary driver of EV/IC. We note that the regression of EV/IC on ROIC has held up rather well over time. Notwithstanding significant changes in stock prices, the second series of

regressions based on June 2 closing prices yield almost identical regressions as the first series of regressions based on the severely depressed data networking April 25 stock prices. Reaffirming our belief that investors inherently already understand and value stocks using economic profitability and not P/E ratios or other GAAP-based earnings metrics, over the last nine months, depending on the particular group of companies in question, the regressions have ranged between approximately 0.65 and 0.99. Deterioration in the regressions over time within each quarter is to be expected as companies' reported financial statements grow stale and given that not all companies report their financial results at the same time.

As noted above, over the course of the past nine months, the regressions in Figures 4–7 have been characterized by an R^2 between 0.6 and 0.99, while the broader regressions in Figures 2 and 3 have ranged between 0.65 and 0.95 and 0.65 and 0.9, respectively. These Figures further support our belief that market valuation is driven by the following:

- The ROIC generated by a company's operations—i.e., the size of the spread between a company's ROIC and its cost of capital.

- The sustainability of such spread.

- The amount of capital that can be invested at such spread.

The strength of each of the above regressions of EVIC on ROIC—both intra-industry and across industries; and, in each case, over time—we believe supports our belief that the market does in fact value stocks based on projected economic returns, taking into account capital requirements and risk, and not based on EPS growth rates or any other GAAP-based earnings metric. Reinforcing this belief, we note that the above regressions appear even stronger when contrasted with the previously discussed regressions of P/E ratios on EPS growth.

It should be noted that, being static and looking at historical returns and valuations, this valuation model does not capture future growth. This shortcoming, however, does not mean that the model is a flawed valuation tool. Too often, we seek a metric or methodology to provide all the answers—moreover, with precision. We refer you to the myths enumerated above. We believe these regressions to be rather meaningful. First, based on their R^2, or goodness of fit, they lend strong support to our belief that return on invested capital is the primary driver of market valuation. Second, they provide a means of comparing such valuations using the universal common denominator of invested capital. Third, and perhaps most importantly, given the first two points above, they provide us with insight into investors' expectations for a company (or an industry) relative to similarly situated companies (industries). While each regression analysis only provides a snapshot, on this portrait of investors' expectations we can overlay our own view as to a company's ability to generate profitable growth; we can thereby form a belief as to whether such expectations, as reflected in the multiple currently assigned by the market to each dollar of capital invested in the company's operations, are too high, too low or reasonable.

Longitudinal Analysis of EVIC/ROIC for the Data Networking Vendors

The line graphs set forth in Figure 8 chart the EVIC/ROIC ratio for the networking industry (defined as the 16 networking vendors included in Figure 2) and for each of

Ascend, Bay, Cabletron, Cisco, 3Com, FORE, PairGain, Shiva, Xylan, U.S. Robotics, VideoServer and each of the prospective Ascend-Cascade and 3Com-U.S. Robotics combined entities since the first month following the initial public offering for each of these respective companies.[8] These graphs show the expanding and contracting multiple assigned to each dollar of capital invested in each of these companies relative to each of their then-prevailing trailing four quarters' return on invested capital. This multiple is a proxy for the measure of investor's expectations and fears regarding the prospects of the networking industry in general and each of the noted companies in terms of the market value drivers discussed above under "The Proof Is in the Pudding," namely: the size of the spread between ROIC and cost of capital that can be generated in the future, the sustainability of such spread (CAP) and the amount of capital that can be applied to generate such spread.

As shown by the graphs, based on closing market prices on April 25, each of Ascend (and Ascend-Cascade), Cascade, Cisco, Cabletron, 3Com (and 3Com-U.S. Robotics), FORE, PairGain, Shiva, Xylan and VideoServer were trading at or near their historical valuation low-points based on EVIC/ROIC. Clearly, investors' expectations for each of these companies were at or near their all-time nadirs and substantially below their zeniths.

The question arises: were each of these significant revaluations warranted in that each such revaluation reflects significantly diminished intermediate- to long-term prospects for profitable growth for each such company and for the industry in general? We emphatically do not believe that there has been a fundamental change in either the intermediate- or long-term demand for data networking products and services. We also emphatically do not believe there has been any change in the competitive landscape within the data networking industry.

Only recently, the market seems to have regained some confidence in the sector's ability to continue to generate sustained value, albeit perhaps not at the levels and over the horizons that previously prevailed, as market valuations have been bid back up off their April lows (although still well below their former highs). While we note that returns on invested capital for several of the networking vendors recently have begun to trend lower, we observe:

- Despite the slowing sequential growth, we continue to believe that the networking industry will continue its rapid growth for the next few years, as networks have become strategic IT platforms. In our opinion, the three primary drivers to this accelerating demand continue to be the upgrading of corporate networks, remote access and the Internet.

- The big four—Cisco Systems, Bay Networks, 3Com and Cabletron Systems—now account for approximately 82% of the industry's revenues and approximately 70% of the industry's profits. Cisco has a dominant share of the industry's profits, with an estimated 48% share of the Q1:97 calendar quarter's profits.

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[8] The initial months or years following the IPO for most of these companies have been omitted for purposes of highlighting each of these companies' most recent past and eliminating the "irrational exuberance" accorded to their market valuations during the periods immediately following their IPOs.

- We believe that the investment opportunities within the industry increasingly will be limited to a few companies; our strongest Buy recommendations continue to be Cisco Systems, Ascend Communications and PairGain Technologies.

Conclusion

As evidenced in Figure 1, notwithstanding its widespread use—and not surprisingly, for the reasons discussed above—given the lack of any meaningful statistical correlation between P/E ratios and EPS growth rates, the use of "P/E to growth rate" as a valuation tool appears to offer no real benefit to the investor, in our opinion. On the other hand, as evidenced in Figures 2–8, ROIC appears to be a significant driver of valuation.

EVIC/ROIC analysis confirms what we already believed to be true: the market is quite efficient in terms of valuing companies. Nevertheless, as noted above, this analysis does not capture growth—whether in terms of ROIC, CAP or the amount of invested capital that can continue to be applied at the current ROIC. This "shortcoming," however, is not a real handicap, in our opinion. Given that valuation is not quantitative or objective, timeless or precise and given the market's fairly high degree of efficiency, it is unclear that valuation provides a meaningful competitive advantage, except in trying to identify companies that have particularly high or low investor expectations relative to their peers and in answering the question posed at the beginning of this report: what is a "rational" or "fair" price to pay for equity in a corporation? Fortunately, by pricing change in the economics of a company's business and capturing the waxing and waning of investors' expectations regarding a company's ability to create future value by profitably growing its business—in terms of the amount of capital that can be invested in its business, the spread between the returns generated therefrom and the cost of such capital, and the horizon over which such spread can be maintained—we believe EVIC/ROIC analysis provides us with a mechanism through which to answer this question.

June 16, 1997

COMPANIES MENTIONED IN THIS REPORT

Company	Ticker Symbol	Price 4/25/97	Price 6/2/97	Price 6/13/97
Amgen, Inc.	AMGN	$56-3/4	$63	$62-3/4
Ascend Communications, Inc.	ASND	$39-1/8	$55-1/8	$41-5/16
Bay Networks, Inc.	BAY	$16-1/8	$24-3/8	$23-5/8
The Boeing Company	BA	$51	$52-11/16	$57-3/8
Cabletron Systems, Inc.	CS	$30-1/4	$45-3/4	$31-3/4
Cascade Communications Corp.	CSCC	$26-7/16	$37-11/16	$28-11/16
Cisco Systems Inc.	CSCO	$46-3/8	$67-13/16	$66-11/16
The Coca-Cola Company	KO	$59-1/8	$67-5/8	$71-7/8
Compaq Computer Corporation	CPQ	$78-5/8	$107-5/8	$100-1/4
Computer Associates Int'l, Inc.	CA	$46-1/4	$56-3/4	$58
Dell Computer Corporation	DELL	$77-3/4	$113-3/8	$111-1/8
FORE Systems, Inc.	FORE	$11-5/8	$17-1/8	$14-5/8
Gateway 2000, Inc.	GTW	$26-5/16	$33-3/16	$31-7/16
Gillette Company	G	$79-1/2	$88	$98-5/8
Hewlett-Packard Company	HWP	$49-1/2	$107-5/8	$53-1/4
Home Depot, Inc.	HD	$56-3/8	$62-7/8	$67-5/8
Informix Corporation	IFMX	$6-27/32	$10-7/16	$8-5/16
Intel Corporation	INTC	$144-7/8	$149-3/4	$144-3/4
Lucent Technologies, Inc.	LU	$55-3/8	$64	$69
McAfee Associates, Inc.	MCAF	$48-1/8	$64-5/8	$60
McDonald's Corporation	MCD	$51-1/8	$48-3/4	$50-1/4
Merck & Co., Inc.	MRK	$87-3/8	$90	$98-5/8
Micron Electronics, Inc.	MUEI	$19-9/16	$17-5/8	$17-3/8
Microsoft Corporation	MSFT	$113-5/8	$124-3/8	$129-5/8
Motorola, Inc.	MOT	$55-3/8	$66-3/4	$70
Netscape Communications Corp.	NSCP	$25-5/16	$29-7/8	$32-1/4
Newbridge Networks Corp.	NN	$29-1/4	$41-7/8	$41-7/8
Nike, Inc.	NKE	$56-1/8	$56-3/8	$59-1/4
ODS Networks, Inc.	ODSI	$12-1/4	$16-3/8	$12-7/16
Oracle Corporation	ORCL	$37-7/8	$49	$52
PairGain Technologies, Inc.	PAIR	$22-1/8	$20-3/8	$19-1/2
PictureTel Corporation	PCTL	$8-5/8	$12-1/2	$11-5/16
Pixar, Inc.	PIXR	$15-1/2	$15-3/8	$15
Quantum Corporation	QNTM	$17-7/8	$19-15/16	$20-1/8
Seagate Technology, Inc.	SEG	$42-1/4	$42-3/8	$39-5/8
Shiva Corporation	SHVA	$8-1/4	$12-3/4	$11-3/8
Sun Microsystems, Inc.	SUNW	$27-1/8	$33-9/16	$35-5/16
Sybase, Inc.	SYBS	$14-7/8	$15-1/2	$15-1/4
3Com Corporation	COMS	$26-3/4	$49-1/16	$47-9/16
U.S. Robotics Corporation	USRX	$46-1/8	$85-3/16	$81-17/32
VideoServer, Inc.	VSVR	$15-3/8	$16-3/4	$13-1/8
Wal-Mart Stores, Inc.	WMT	$27-1/8	$30-3/8	$32
The Walt Disney Company	DIS	$77-3/8	$80-7/8	$83-1/2
Xylan Corporation	XYLN	$14-1/2	$22-5/8	$14-3/4

Figure 1: P/E VERSUS EARNINGS GROWTH

Source: Robertson, Stephens & Company.

Figure 2A: EV/IC VERSUS ROIC ■ *Networking Universe (4/25/97)*

$y = 15.801x + 3.4764$
$R^2 = 0.5771$
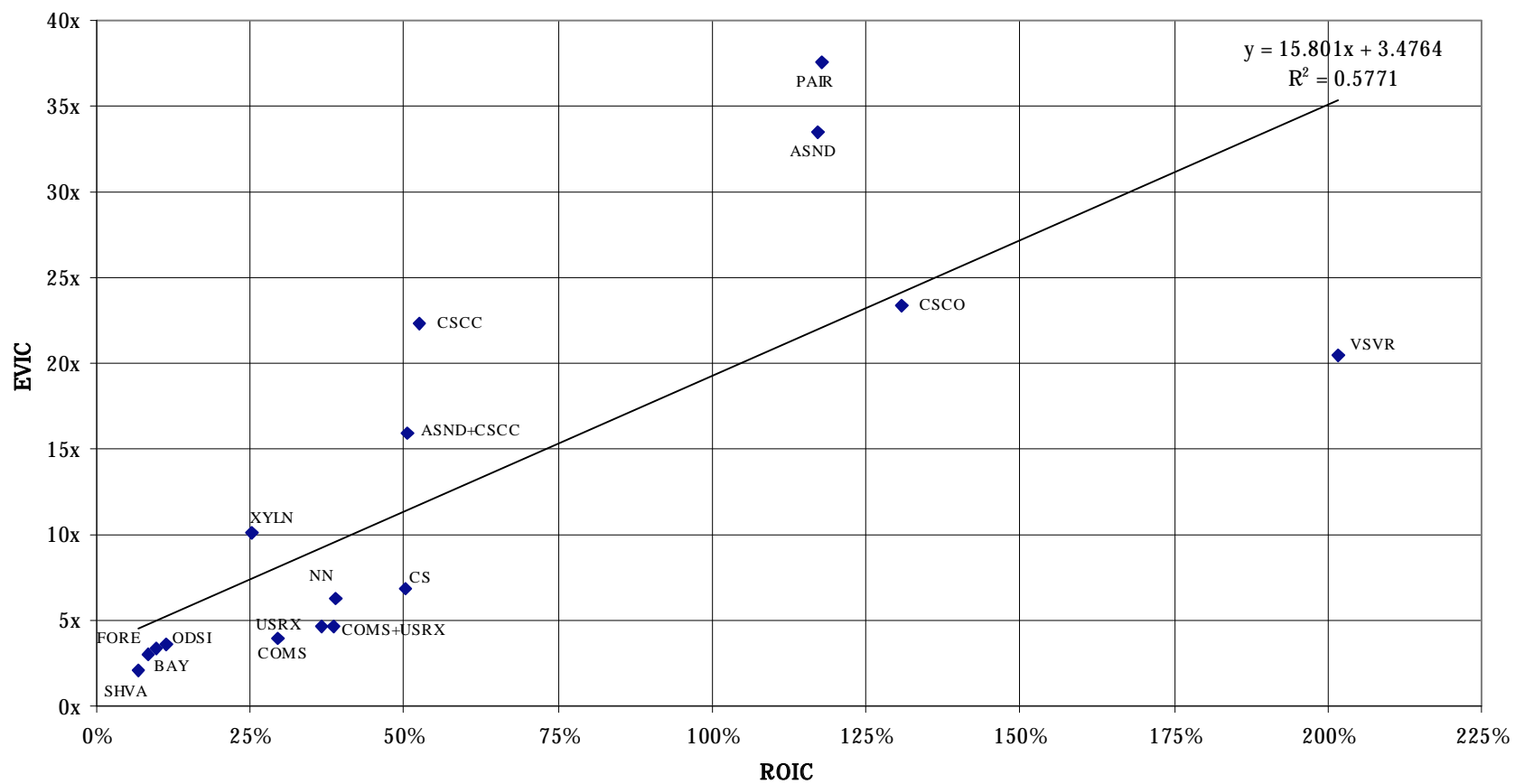
Source: Robertson, Stephens & Company.

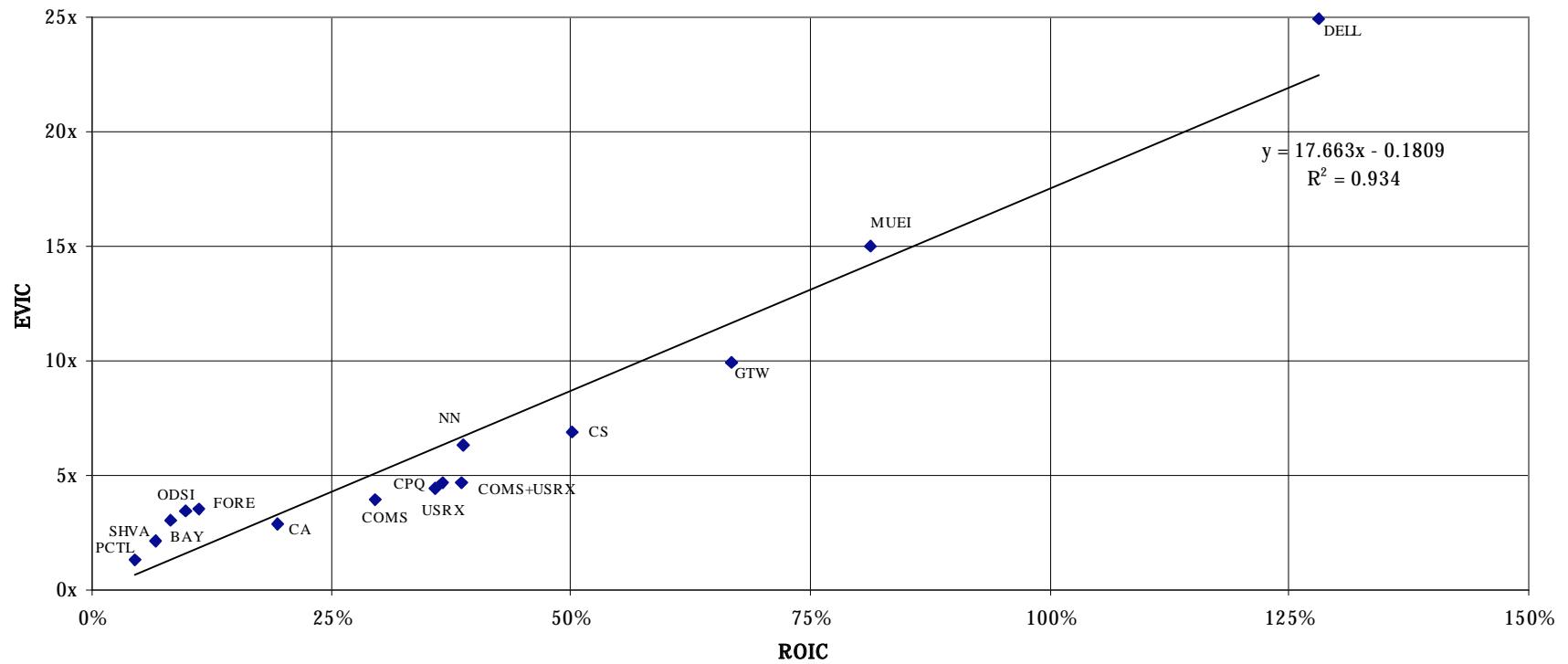**Figure 2B: EV/IC VERSUS ROIC** ■ *Networking Universe (6/2/97)*

Chart: EV/IC versus ROIC scatter plot. Y-axis labeled "EVIC" ranging from 0x to 60x. X-axis labeled "ROIC" ranging from 0% to 225%.

Trendline equation: $y = 21.554x + 5.4131$, $R^2 = 0.6766$

Data points (labels): ASND &CSCC, ASND, CSCC, CSCO, PAIR, VSVR, XYLN, COMS &USRX, CS, USRX, NN, COMS, FORE, ODSI, BAY, SHVA

Figure 3A: EV/IC VERSUS ROIC ■ *Networking Industry Plus 14 Non-Networking Gorillas and 7 Non-Networking Chimpanzees (4/25/97)*

$y = 26.222x - 0.7547$
$R^2 = 0.7925$

Source: Robertson, Stephens & Company.

Figure 3B: EV/IC VERSUS ROIC ■ *Networking Industry Plus 14 Non-Networking Gorillas and 7 Non-Networking Chimpanzees (6/2/97)*

Scatter plot with y-axis labeled EVIC (ranging from 0x to 110x) and x-axis labeled ROIC (ranging from (25)% to 300%).

Regression equation shown on chart:
$$y = 31.197x - 0.1939$$
$$R^2 = 0.8283$$

Data points labeled: MSFT, MCAF, ASND & CSCC, ASND, PIXR, CSCC, CSCO, PAIR, DELL, VSVR, NSCP, ORCL, COMS, KO, XYLN, AMGN, MUEI, ODSI, BAY, WMT, NN, CS, GTW, INTC, BA, G, MRK, USRX, DIS, HD, CA, LU, SUNM, IFMX, PCTL, SHVA, SYBS, MCD, MOT, FORE, QNTM, NKE, SEG, CPQ, HWP, COMS & USRX

Source: Robertson, Stephens & Company.

Figure 4A: EV/IC VERSUS ROIC ■ *Gorillas (4/25/97)*

$$y = 31.655x - 2.449$$
$$R^2 = 0.9387$$

Source: Robertson, Stephens & Company.

Figure 4B: EV/IC VERSUS ROIC ■ *Gorillas (6/2/97)*

$y = 37.225x - 2.4733$
$R^2 = 0.9527$

Source: Robertson, Stephens & Company.

Figure 5A: EV/IC VERSUS ROIC ■ *Networking Chimpanzees (4/25/97)*

$$y = 8.4471x + 2.1362$$
$$R^2 = 0.8313$$

Source: Robertson, Stephens & Company.

Figure 5B: EV/IC VERSUS ROIC ■ *Networking Chimpanzees (6/2/97)*

$y = 14.116x + 3.6678$

$R^2 = 0.9869$
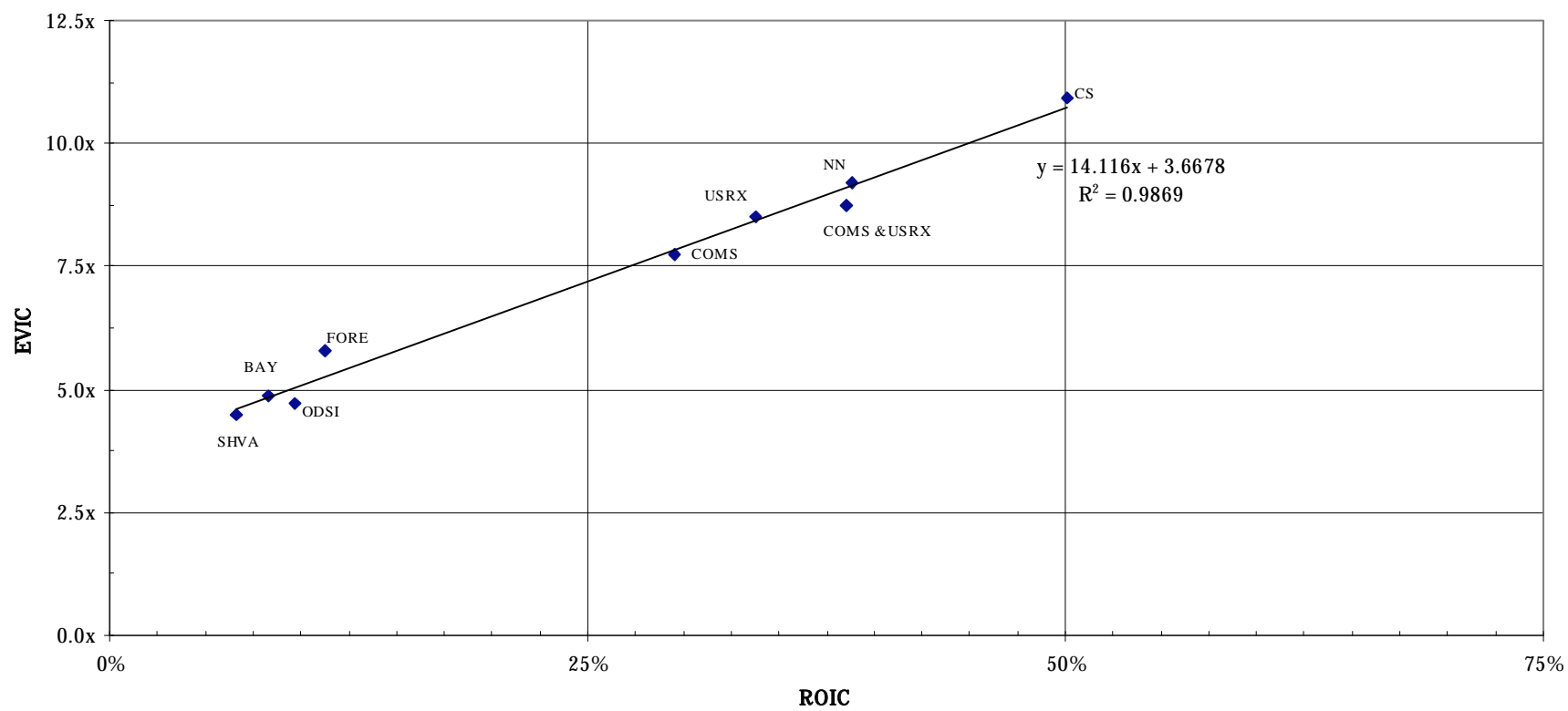
Source: Robertson, Stephens & Company.

Figure 6A: EV/IC VERSUS ROIC ■ *Chimpanzees (4/25/97)*

$y = 17.663x - 0.1809$
$R^2 = 0.934$

Source: Robertson, Stephens & Company.

Figure 6B: EV/IC VERSUS ROIC ■ *Chimpanzees (6/2/97)*

$y = 21.097x + 1.2581$

$R^2 = 0.9074$
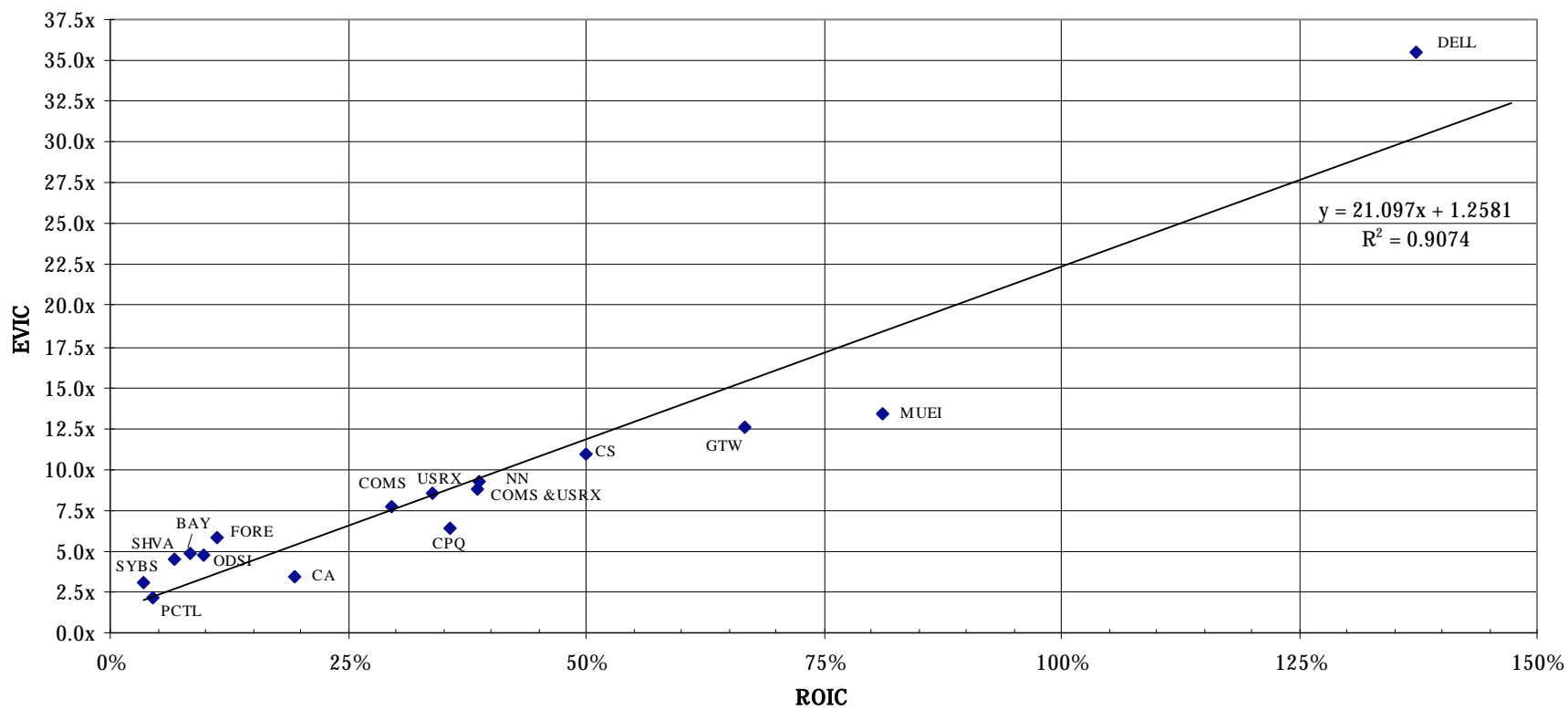
Source: Robertson, Stephens & Company.

Figure 7A: EV/IC VERSUS ROIC ■ *Emerging Networking Vendors (4/25/97)*

$y = 25.268x + 6.3742$
$R^2 = 0.908$
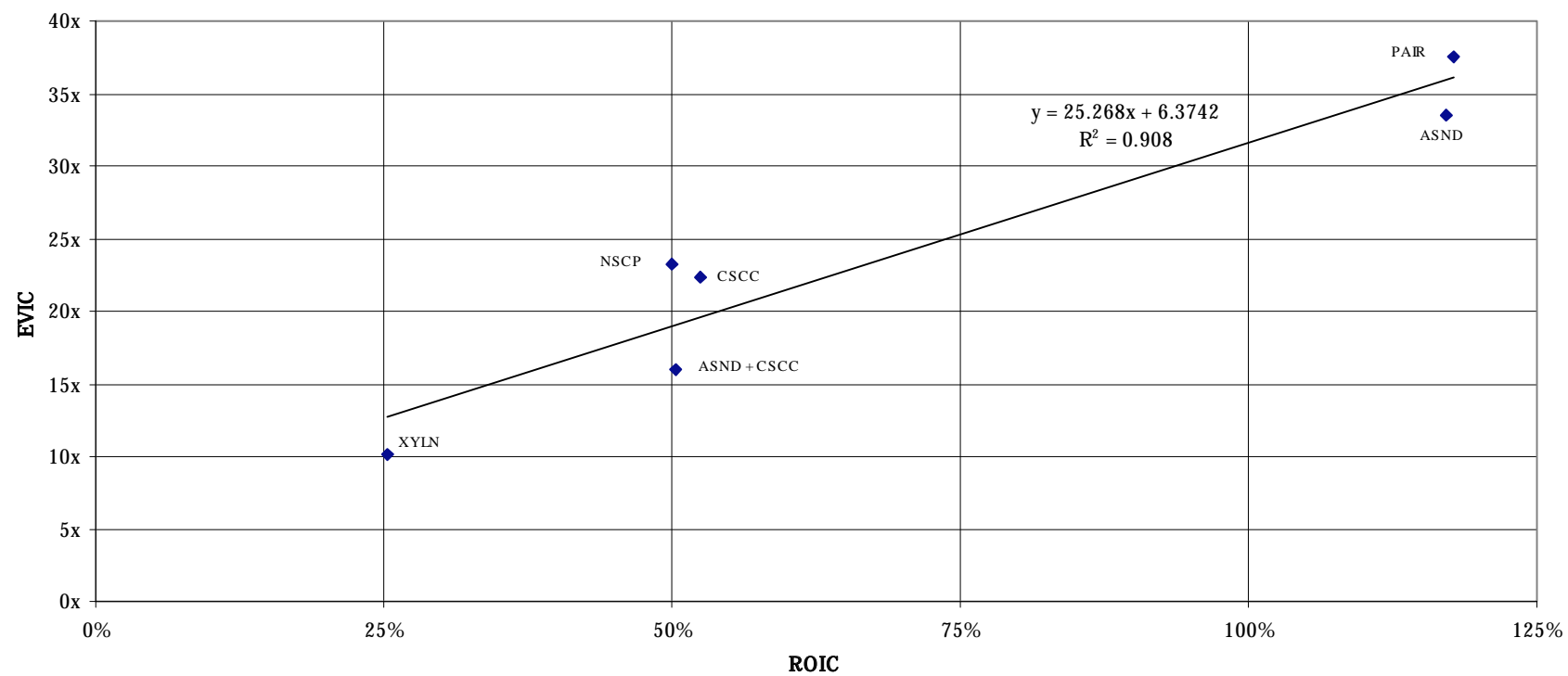
Source: Robertson, Stephens & Company.

Figure 7B: EV/IC VERSUS ROIC ■ *Emerging Networking Vendors (6/2/97)*
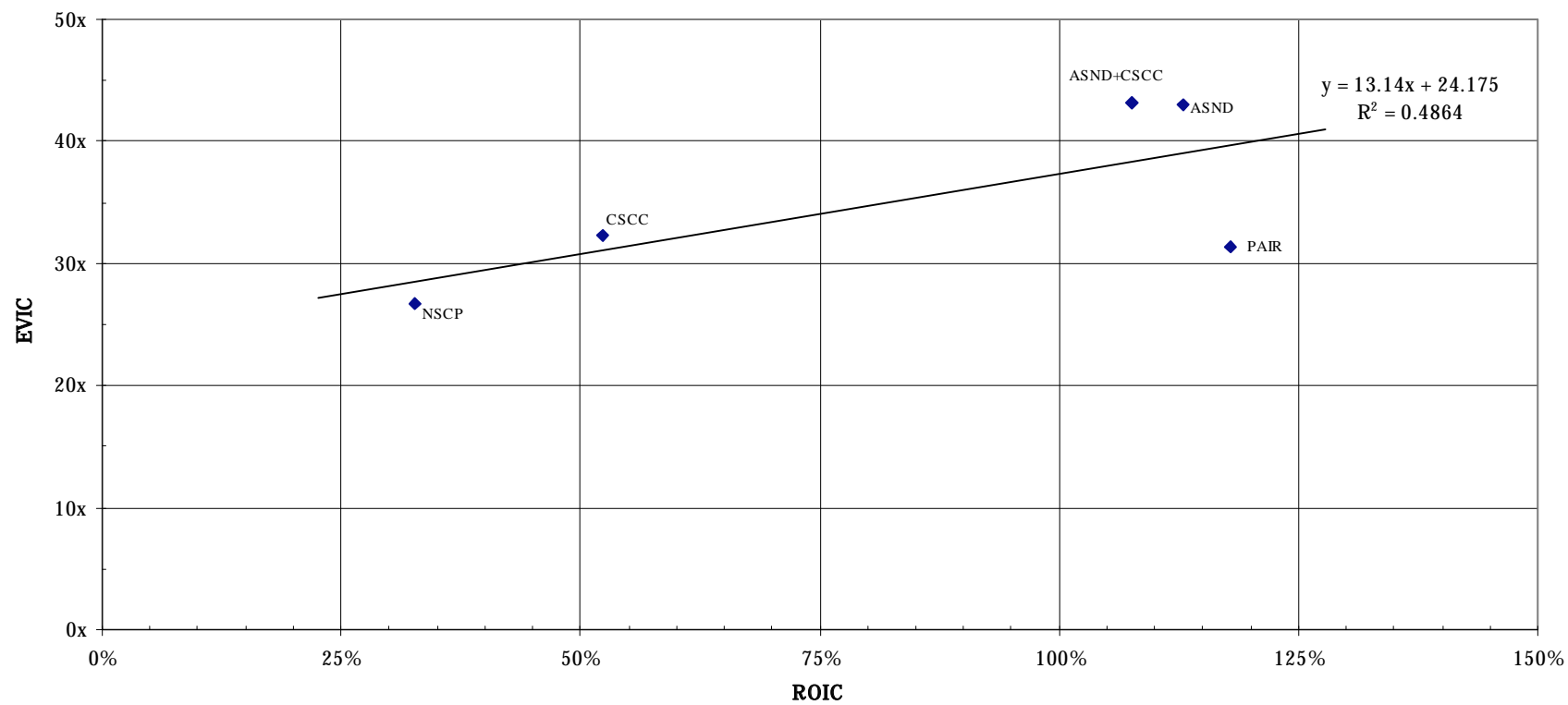
Source: Robertson, Stephens & Company.

Figure 8A: NETWORKING INDUSTRY EVIC/ROIC ■ *(1/94–5/97)*
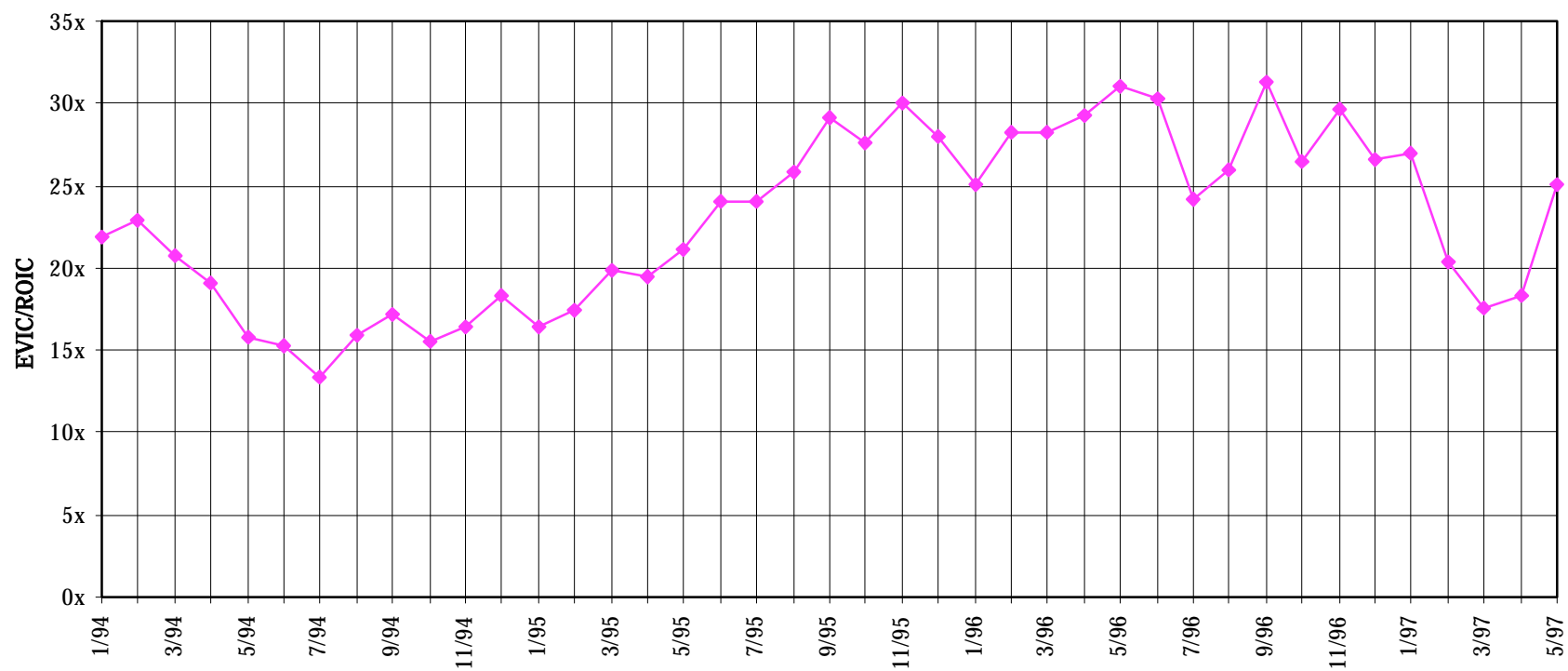
Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Figure 8B: ASCEND COMMUNICATIONS, INC. EVIC/ROIC ■ *(7/94–5/97)*
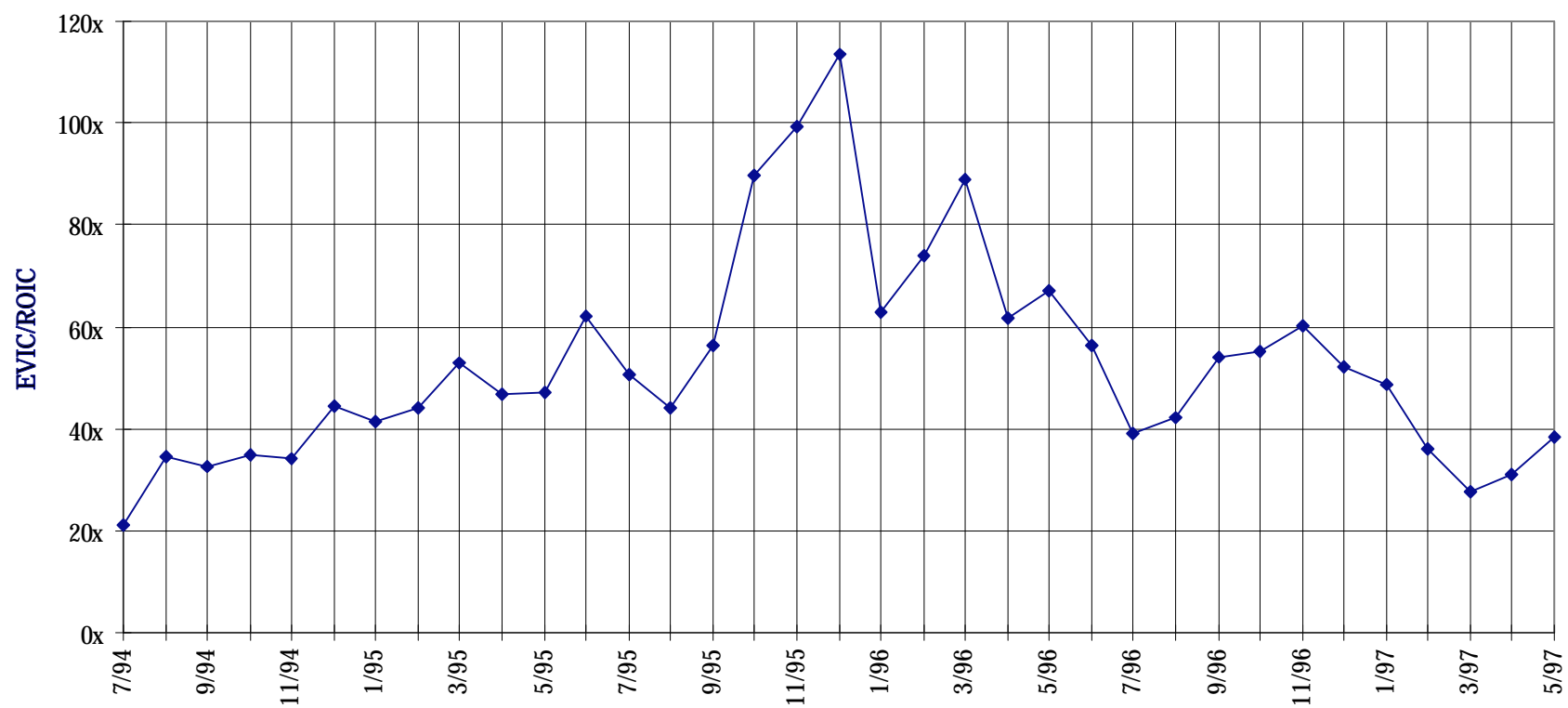
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8C: ASCEND COMMUNICATIONS, INC. + CASCADE EVIC/ROIC ■ *(7/94–5/97)*
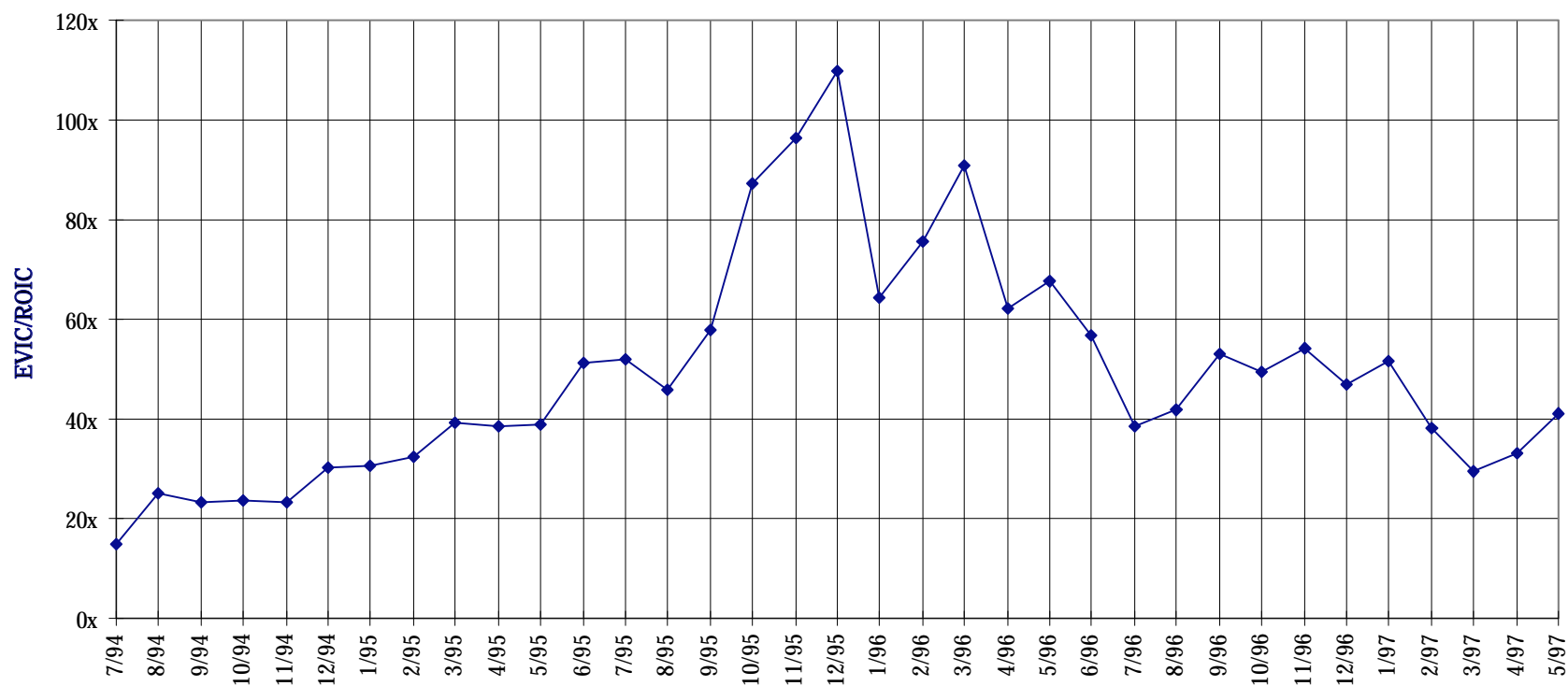
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8D: CASCADE EVIC/ROIC ■ *(7/94–5/97)*
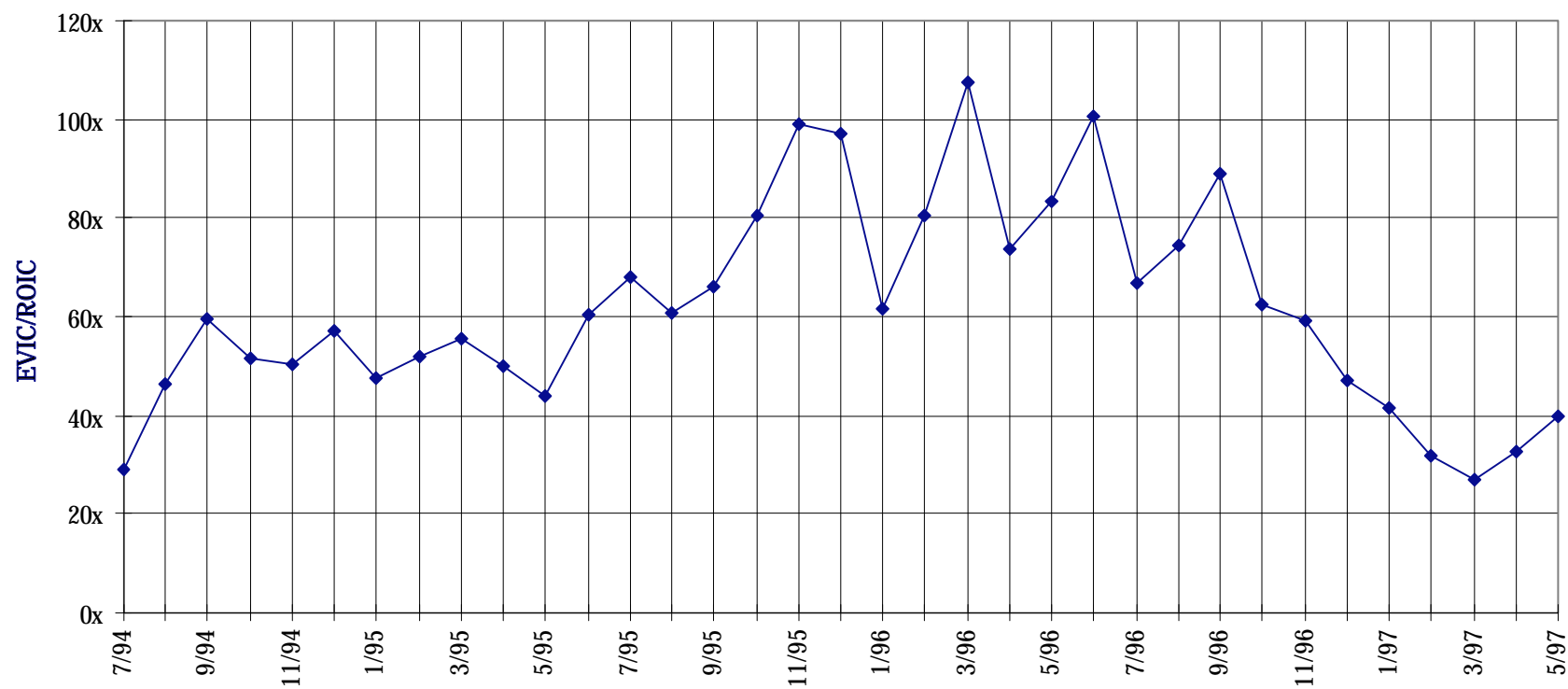
Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Figure 8E: BAY NETWORKS, INC. EVIC/ROIC ■ *(7/91–5/97)*
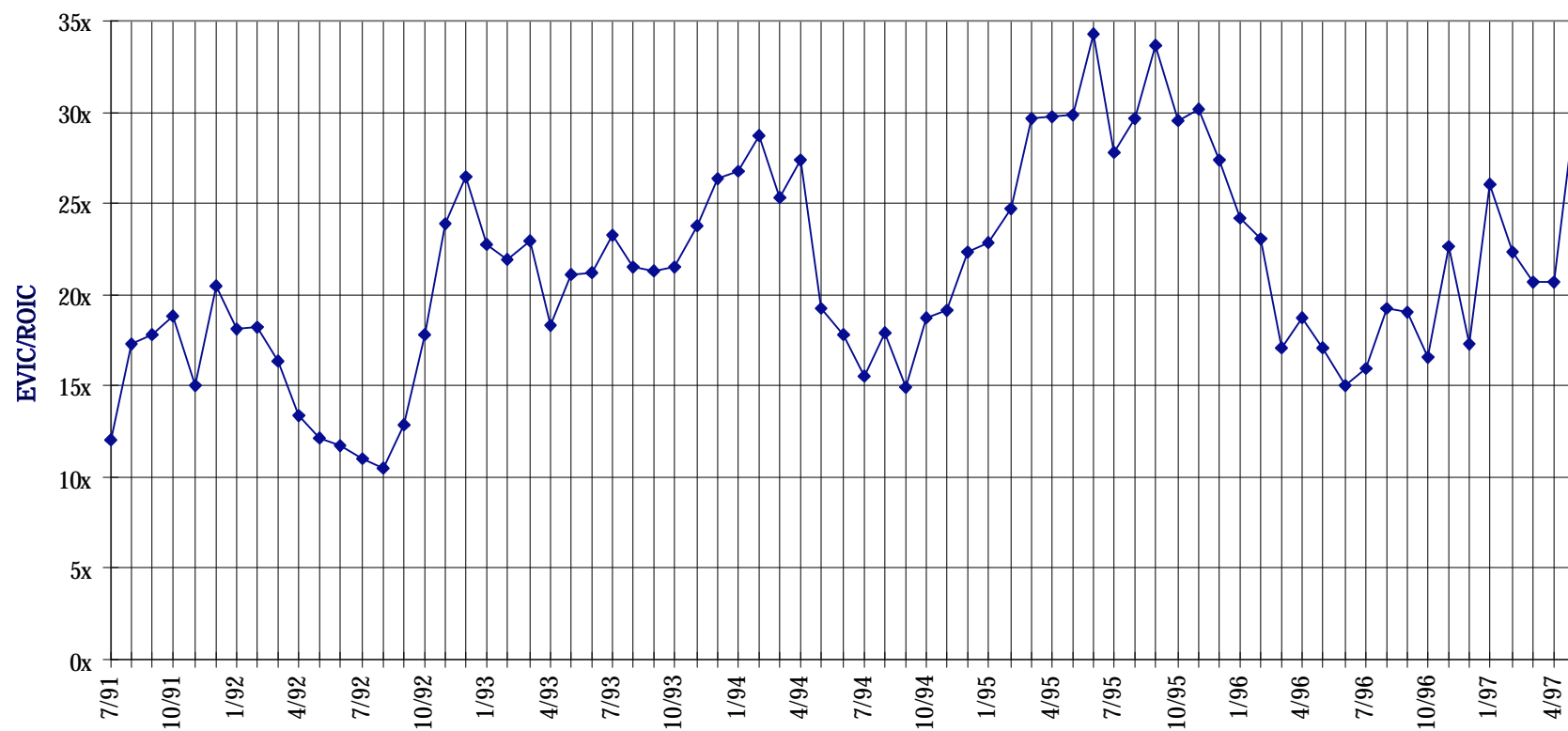
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8F: 3COM CORPORATION EVIC/ROIC ■ *(12/92–5/97)*
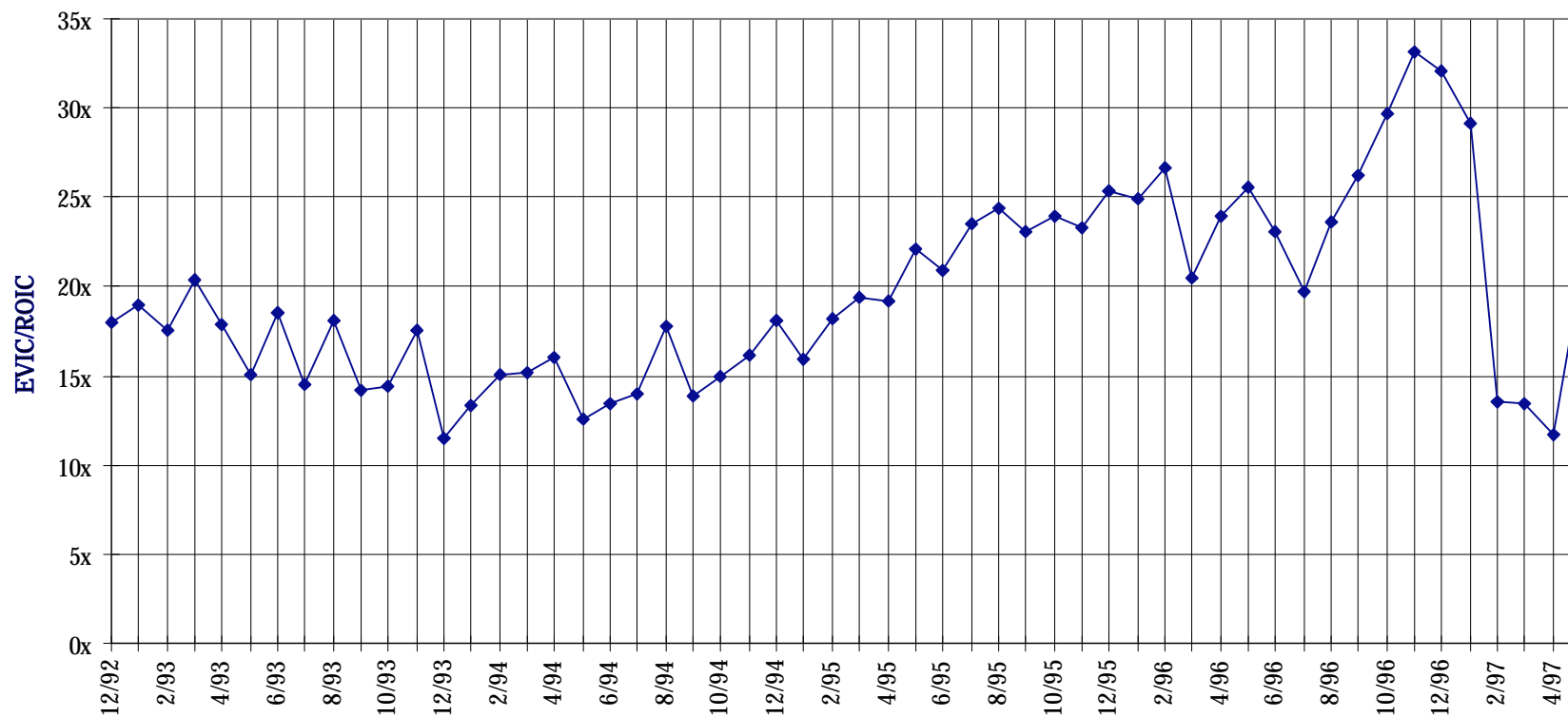
Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Figure 8G: CISCO SYSTEMS, INC. EVIC/ROIC ■ *(2/92–5/97)*
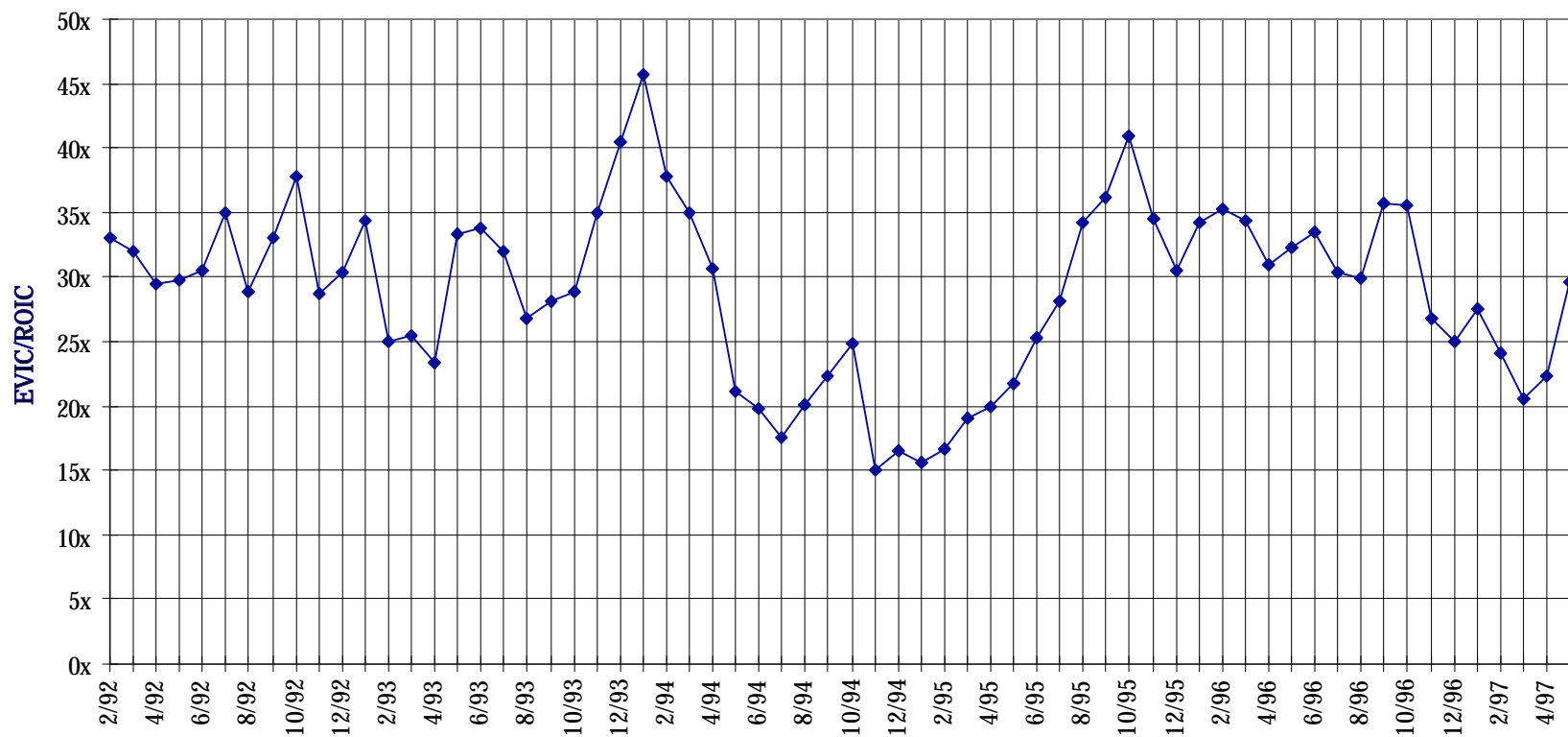
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8H: CABLETRON SYSTEMS, INC. EVIC/ROIC ■ *(1/93–5/97)*
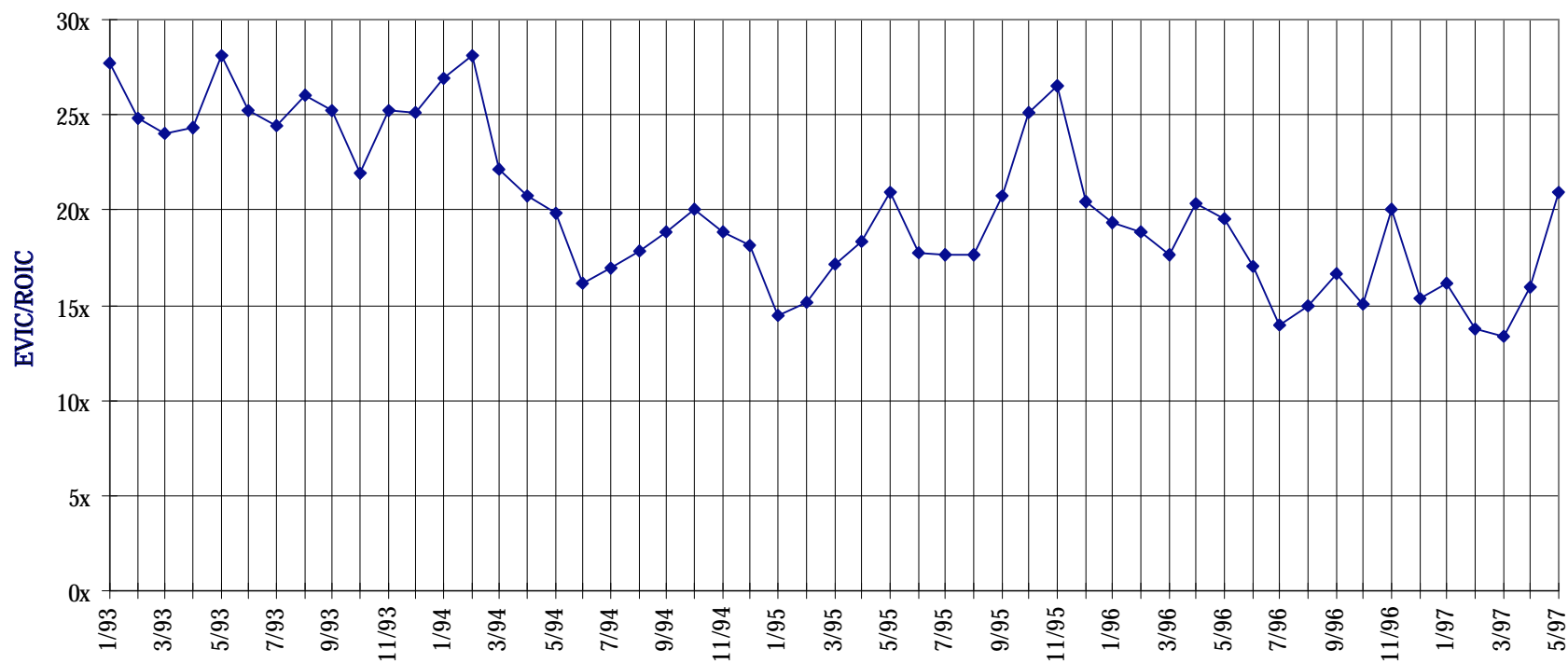
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8I: FORE SYSTEMS, INC. EVIC/ROIC ■ *(5/94–5/97)*
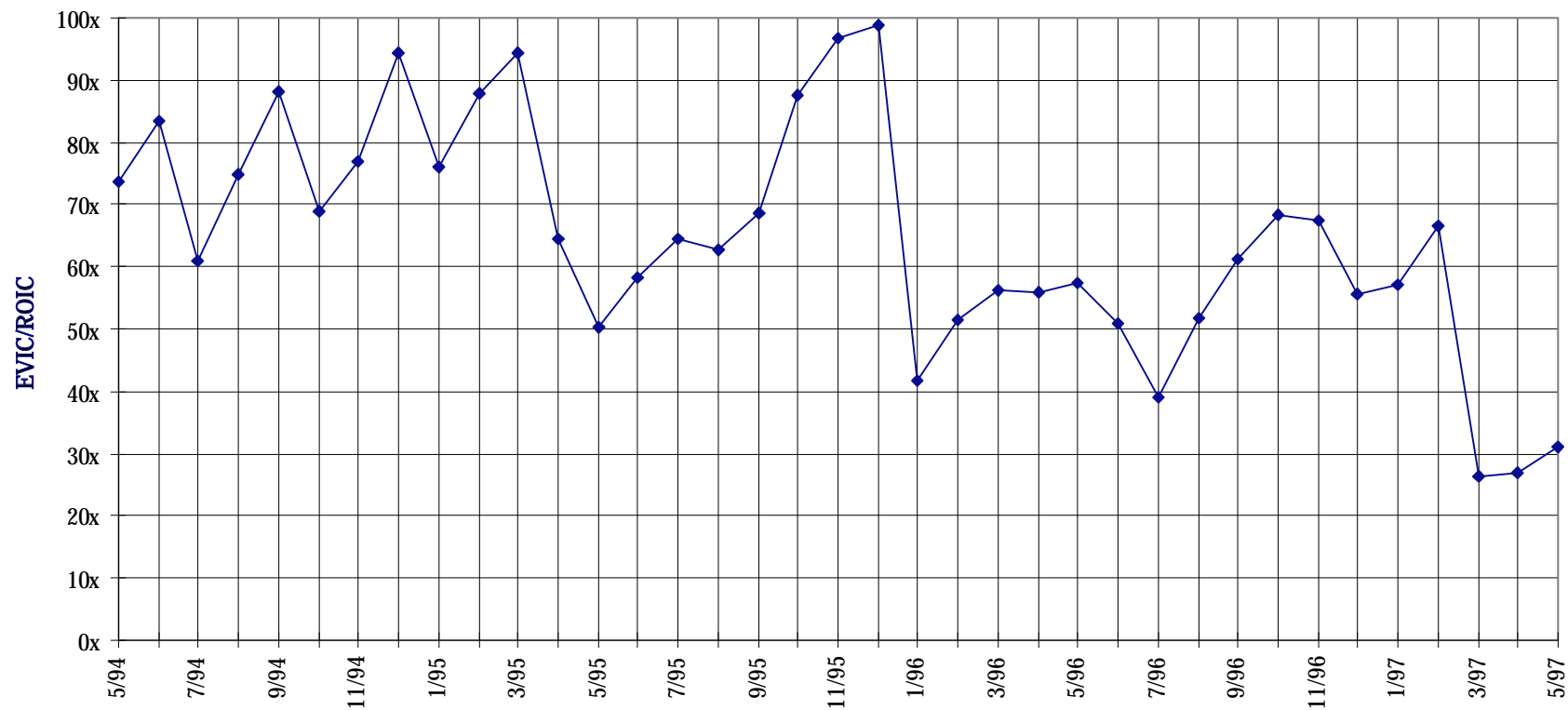
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8J: PAIRGAIN TECHNOLOGIES, INC. EVIC/ROIC ■ *(6/96–5/97)*

Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8K: SHIVA CORPORATION EVIC/ROIC ■ *(11/94–5/97)*
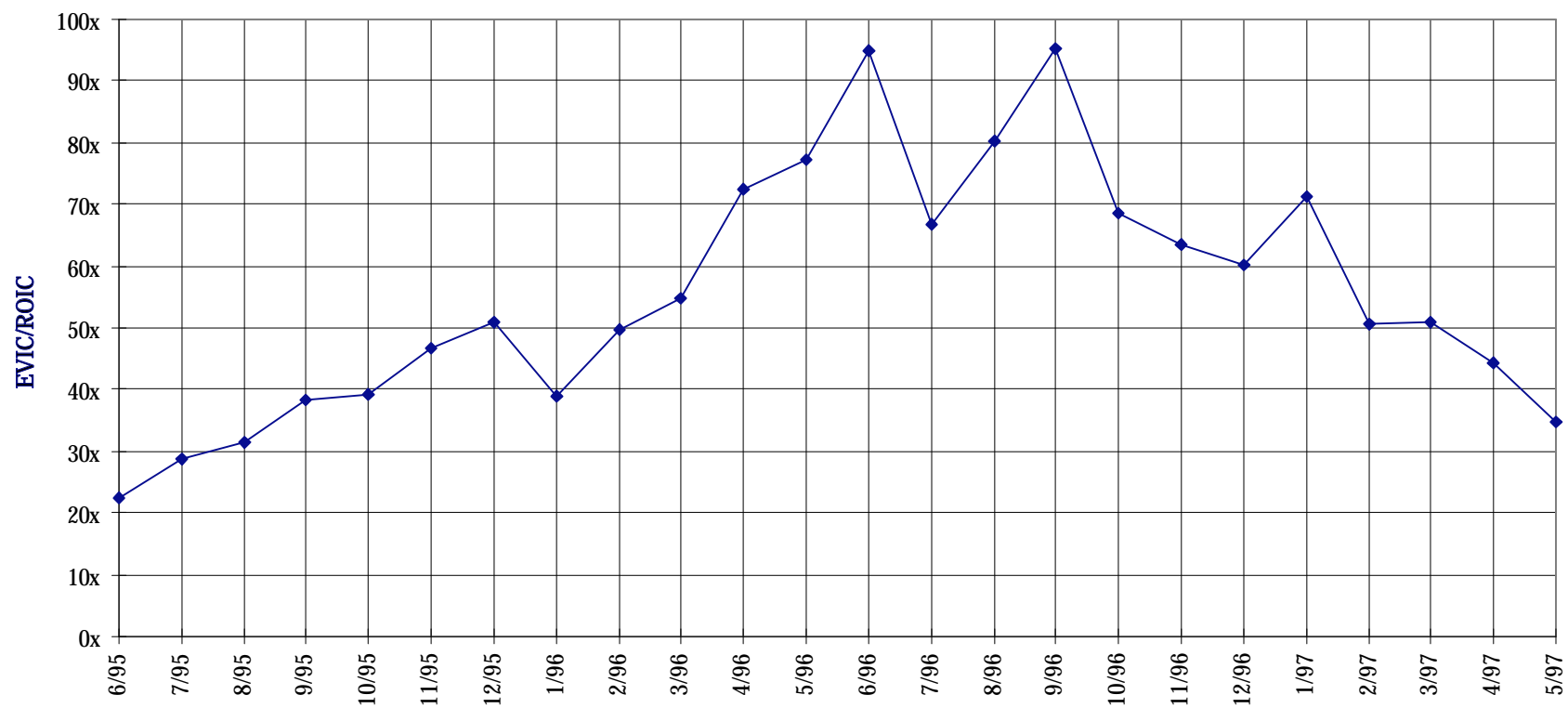
Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Figure 8L: VIDEOSERVER, INC. EVIC/ROIC ■ *(12/95–5/97)*
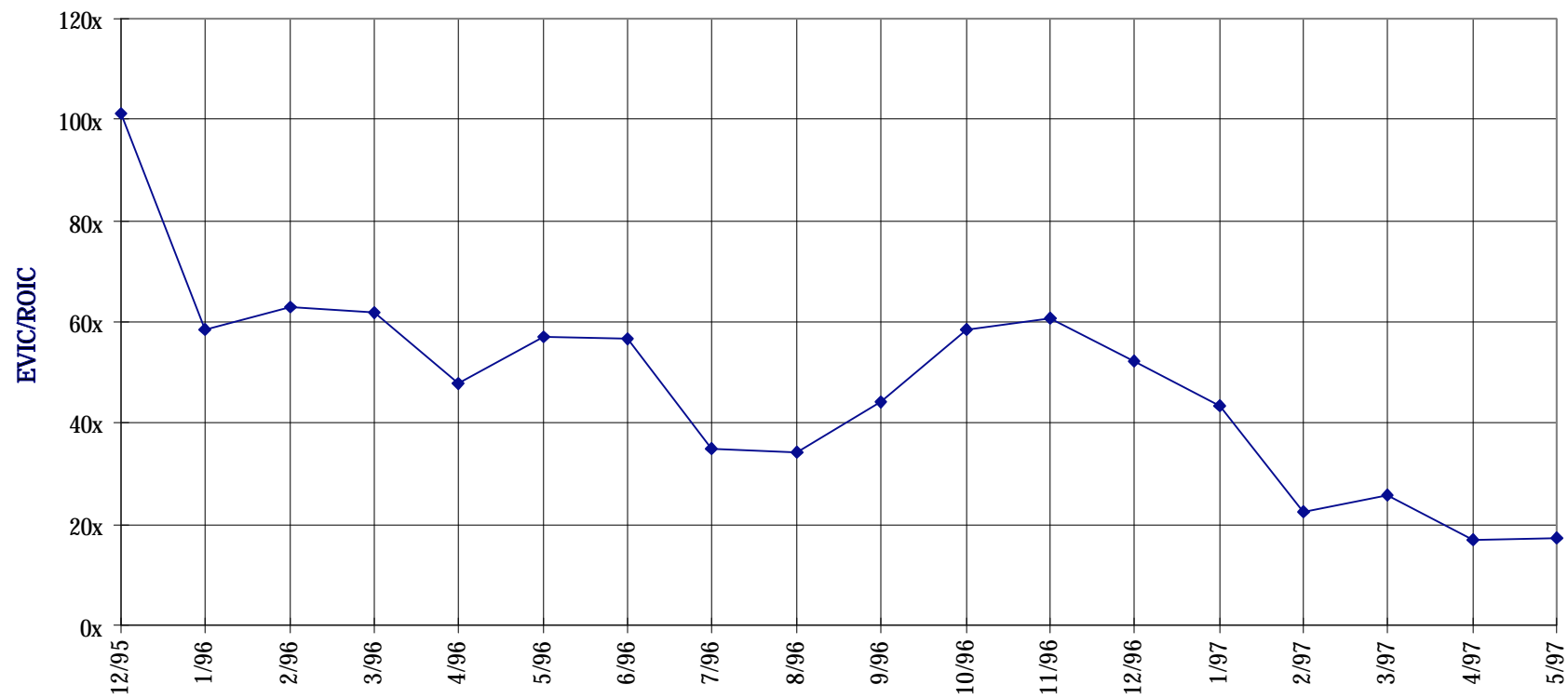
Based on monthly closing prices.

Source: Robertson, Stephens & Company.

Figure 8M: XYLAN CORPORATION EVIC/ROIC ■ *(3/96–5/97)*
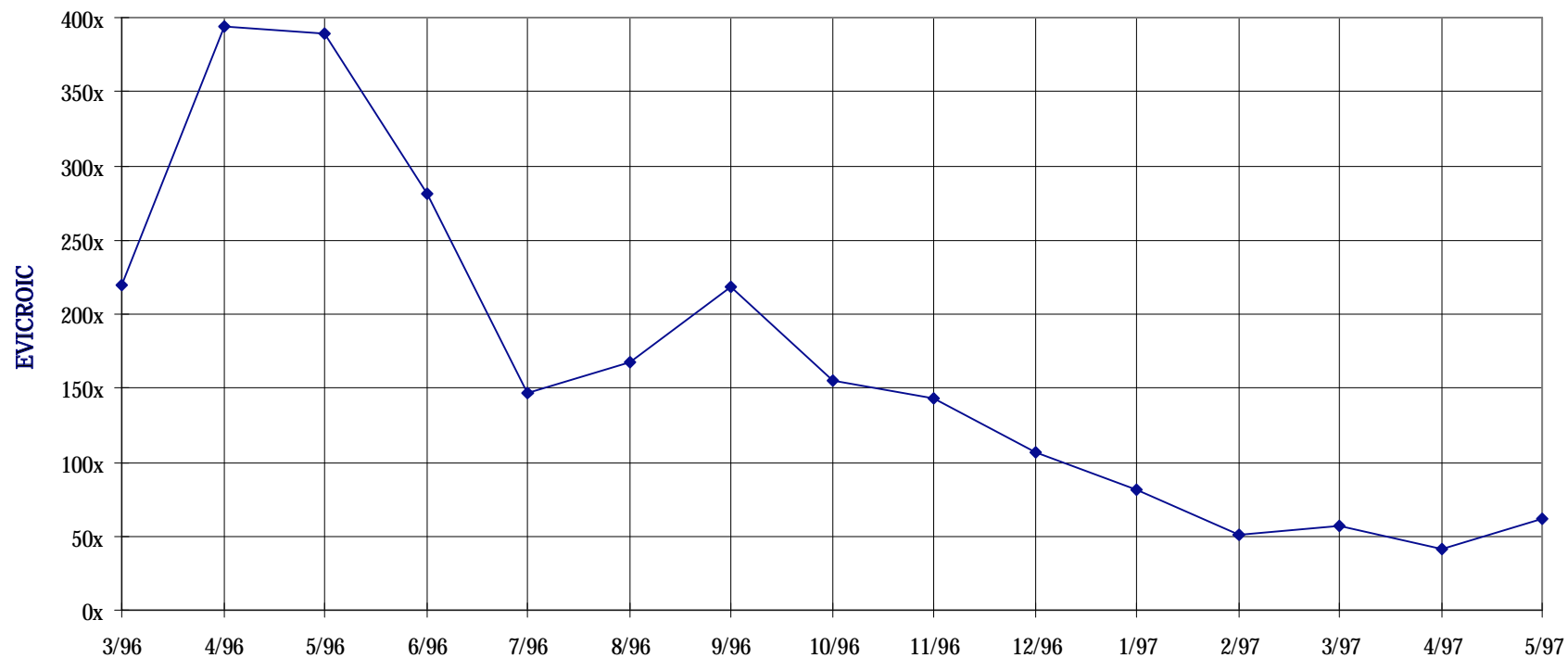
Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Figure 8N: U.S. ROBOTICS EVIC/ROIC ■ *(1/94–5/97)*

Based on monthly closing prices.
Source: Robertson, Stephens & Company.

Additional information is available upon request.

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Paul joined RS&Co. in 1994 as a managing director covering the networking and telecommunications industries. He has been a technology analyst for 14 years and has been named one of the nation's best analysts by *Institutional Investor* for three consecutive years. Paul is also a professor of securities analysis at the Graduate School of Business, Columbia University. He holds a BA in economics from the University of California Berkeley, and an MBA in finance from the Executive Program at the Wharton School of the University of Pennsylvania.

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