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# FAILURE OF THE ANALYST IN THE COLLAPSE OF INTEL 2001

## INTRODUCTION

One of the most surprising factors of the stock market decline of 2000 was how many of the Wall Street Security Analysts completely missed the warning signs prior to the decline. “Security prices are expected to reflect available information, according to the strong and semi strong version of the “efficient market hypothesis.” A precondition for this strong and semi strong version of the hypothesis is that information and trading costs approach zero ( Fama, 1965 p. Stigler ). In September of 2000, the Market Capitalization of Intel Corporation, a single company, fell more that 250 Billion Dollars in less than a one-month period. That is more than the total cost through 2005 of the War in Iraq, the expected cost of the Katrina cleanup, and only slightly less than the federal budget deficit of the United States for the entire year 2004. In September of 2000 “If there were one company to which the semi-strong form of the efficient market hypothesis ought to apply, it would be Intel,” simply because of the number of Wall Street analysts covering the stock and the number of large institutions which has held the stock (Cornell 2000 p. 1).

The stock price of Intel ultimately reached equilibrium when all the information was correctly processed. The delays in correctly pricing Intel caused tremendous disruption and inefficiency within the markets. This paper will concentrate on the Intel decline arguing that many analysts miss priced Intel because of an inherent limitation in the models that they employed, principally the discounted cash flow (DCF) models, and it variations, derived from capital asset pricing models (CAPM). It will develop as an

alternative, a variation of a multi-factor model, with financial forecasting potential. Unlike the standard models multi-factor models, which focuses on risk this model will concentrate on the expected residual return or a forward-looking version of alpha. In addition instead of concentrating on the return to a balanced portfolio, this paper will be concerned with projecting the returns to sub-sectors of the economy. The goal is to create a forecasting model from the perspective of consumption based models using data most appropriate to each sub-sector of the economy. For example, the paper will develop a model which utilizes information on shipments of computers, semiconductors, new orders for computers, semiconductors etc in a multi-factor model, in an attempt to project expected returns. The model will be presented as an alternative to the various CAPM Discounted Cash Flow (DCF) models, which are so dominant in the industry for purposes of evaluation.

## INTEL CORPORATION: A CASE STUDY

From June 1, 1999 to September 1, 2000 the stock of Intel Corporation had risen from $25.34 to $75.69. On September 5, Ashok Kumar an analyst at Piper Jaffray issued a downgrade from a strong buy to a buy stating that he is "maintaining his street low Revue estimate." Kumar stated:

- Continued demand weakness could result in unit growth, which is well below consensus expectations
- Seasonal recovery has yet to materialize, with APAC being particularly disappointing
- Due to imminent oversupply, pricing environment could turn malignant
- Expect current gross margins expansion trends will reverse with the ramp of P4.
- With weakening fundamentals, we believe the relative strength of the stock has peaked.

He went on to state that:

> "Due to continued unexpected demand weakness, we now expect sequential unit growth in the mid-single digits, which is well below consensus expectations. Furthermore, our lowered expectations impute a meaningful pickup in demand over the next three weeks. If this turn does not materialize, there could be further risk to our revenue estimate, which is at the low end of the Street."
> As Intel's build plans were substantially higher than current sell through, we expect a meaningful inventory overhand going into the December quarter. Coupled with the possibility that current manufacturing commitments for the December quarter may be to optimistic, this sets the groundwork for a malignant pricing environment." (Kumar Sept 5, 2000)

By the end of the day the stock had reseeded to a close of $69.25 a loss of x % and within two weeks had hit a low of 53.35, just above the support level of May. It then went back to close at 61.48 by September 21, 2000, helped by an upgrade by Bank of American Securities on September 19, 2000, after they issued a downgrade on September 13th.

On September 21, 2000 after the close of the market Intel Corporation issued a press release warning that second quarter revenues would be below market expectations. The release states:

- The company expects revenues for the third quarter of 2000 to be approximately 3 to 5 percent higher than second quarter revenue of $*.3 billion.
- The company expects gross margins percentage for the third quarter to be 62 percent, plus or minus a point.
- Gross margin percentage for 2000 is expected to be 63 percent, plus or minus a few points. In the short term, Intel's gross margin percentage varies primarily with revenue levels and product mix as well as changes in unit costs.
- Expenses (R&D, excluding in-process R&D, plus MG&A) in the third quarter of 2000 are expected to be up 7 to 9 percent from second quarter expense of $2.2 billion, primarily due to higher spending on marketing programs and R&D initiatives in new business areas. Expenses are dependent in part on the level of revenue.
- R&D spending, excluding in process R&D, is expected to be approximately $4.0 billion for 2000.
- The company expects interest and other income for the third quarter of 2000 to be approximately $900 million. Interest and other income is

dependent in part on interest rates, cash balances, equity market levels and volatility, the realization of expected gains on investments, including gains on investments acquired by third parties and assuming no unanticipated items.

- The tax rate for 2000 is expected to be approximately 31.8 percent, excluding the impact of the previously announced agreement with the Internal Revenue Service and acquisition-related costs.
- Capital spending for 2000 is expected to be approximately $ 6 billion .
- Depreciation is expected to be approximately $790 million in the third quarter and $3.4 billion for the full year 2000.
- Amortization of goodwill and other acquisition-related intangibles is expected to be approximately $400 million in the third quarter and $1.5 billion for the full year 2000.

Cornell summarizes this release by stating that the profit warning was relatively modest with:

> The critical exception being the statement regarding future revenues. The warning issued by Intel predicted revenue growth for the third quarter at 3 to 5 percent. This was well below the range of 8 to 12 percent forecast by Wall Street analysts and even below the number of 6 percent projected by Ashok Kumar. Further, the lower revenue number implied that margins would decline slightly because of the fixed nature of some of Intel's short-run costs. (Cornell p. 7).

Following the release the stock lost another 30% of it market value and by the end of September it was trading in the mid 30's a loss of 53% of its market value in one month for one of the successful companies in America and on September 1, 2000 the only company valued at 500 billion dollars.

If the warning was modest Cornell asks: given the steep decline what does this say about the valuation of Intel based on a discounted cash flow (DCF) valuation. He continues by asking was the stock overvalued, before the announcement and undervalued after the announcement, and why were there no better valuations of the company by analysts (Cornell p.).

My question is somewhat different. Cornell correctly observed "by September 21 Intel's price was already down 15 percent form the high, largely on Kumar's warning

about third quarter demand" (p. 9). Is this not the key question: could the down turn in Intel's stock price have been anticipated, and not whether it had been priced correctly. How did Kumar anticipate that there was trouble and is there to much reliance of DCF models by analysts, and not sufficient emphasis on determining if there are changes in potential expectations, without the company telling them this. Are the analysts too wedded to the accounting data, information from the companies, their product line, and the information from competitors, suppliers, and customers, to really see what is happening in the industry when there may be unanticipated changes?

## METHOD: THE APPROACH OF FOUR ANALYSTS PRIOR TO SEPTEMBER 5, 2000 DOWNGRADE BY KUMAR

Using the Thomson Financial database there are an array of analyst reports beginning in the early 1990's and going forward to the current period. During the summer of 2000 the Thomson database has reports from four major research firms on Intel: Morgan Stanley, Prudential Securities, Solomon Smith Barney, and Piper Jaffray.

The lead analyst respectively for each of these firms was: Mark Edelstone, Hans Mosesmann, Jonathan Joseph, and Ashok Kumar. Only Edelstone is currently with his original firm. The objective of reviewing these reports is to determine what method was being utilized in the analyst's determination of rating and price targets for Intel. Prior to September 5, 2000 when Kumar lowered his rating all four analysts had a strong buy rating on the stock, except for Solomon, which had a buy rating. Morgan Stanley had a Strong Buy rating, Prudential had a Strong Buy (Low Risk), 1 M Buy, medium Risk, and Jaffray, had a Strong Buy Aggressive.

A review of each of these analysts' approaches indicates that they all used some form of DCF model with a heavy emphasis on constant growth year over year. Morgan Stanley started covering Intel from at least the late 1980's. The earliest report that the Thompson database has is dated March 14, 1989. Edelstone's first report that was found was his September 30, 1997 report. This report was page 64 of a much larger report, but by October 30,1997 one month later Edelstone had written the first full report listed in the database.

The report while informative about the business and the product lines made projections about the future income and revenue of the company based on sequential and year over year growth expectations. Given the expected revenue stream year over year he estimated quarter over quarter revenues and from there given past ratios for the cost of good sold, tax rates, etc he was able to derived some earning number. In each instance from October 30, 1997 through the critical date of July 26, 2000 Edelstone proceeded with basically the same method, even though his estimates at times were significantly off the mark. If we fast-forward to the present the core approach is the same. On July 20, 2005 Edelstone et al write: "Our stock-price target for INTC is based on our DCF model …we assume a long-term growth rate of 4%. In addition, our price target assumes that Intc should be valued at 4 times our 22006 revenue per share estimate." (p. 2, July 20, 2005). The greatest improvement that I can tell is that he has a better season adjustment metric, which he does not discuss. Ultimately, he is still functioning on revenue driven DCF model. He still cannot explain a shock to the system and has no forecasting metric that can assist him in this regard. He missed the call in September of 2000, and under the same circumstances, I believe he would miss it again.

In July of 2000 Mosesmann of Prudential had the exact same forward projections of revenues, as did Edelstone. Mosesmann had 9,100,000 Q3E-Sept 2000 and 10,300,000 for Q4E-Dec 2000, meaning they probably relied on company information and believed what they heard without critical reflection. From there Mosesmann worked the accounting to get his projected revenue estimates. Joseph on July 19, 2000 wrote that management is trying to reign in analyst expectations for Q3, which have been running high, and are generally advising 7-9% sequential revenue growth; we are forecasting 10% growth. Joseph as so many of the analysts was pushing the envelope.

Ashok Kumar through August 29, 2000 was following the group. He had a strong buy on the stock. His revenue estimate of Q3E was 9.3B as opposed to Edelstone and Mosesmann's 9.1 but only 9.9 for Q4E. On September 5, 2000 following the long Labor Day weekend he issued a downgrade on the Stock. His reasons were: continued demand weakness and seasonal recovery has yet to materialize, creating oversupply and possible pricing problems. What did Kumar find over the weekend. In discussions with him it appears that he began to look beyond the company. By September of 2000 there was a myriad of available data that was indicating that Intel was indeed in trouble, well before the announcement.

## THEORY: VALUATION MODELS VS. FORECASTING MODELS

### The Discounted Cash Flow approach:

Cornell made his assessments regarding the decline in the stock price of Intel based on a discounted cash flow (DCF) valuation model. He contends that:

> by calibrating the model using pre-announcement cash flow projections, based to the greatest extent possible on pre-announcement analyst reports, it is possible to

> calculate how much those forecasts must have changed in order to explain the movement in the stock price (p9).

While the DCF approach is valid it assumes that one has knowledge of the "expected" cash flow to the firm beyond $t_1$ in period $t_2$ to $t_n$. The standard DCF model calculates the value of a firm based on the expected cash flow to the firm in period $t_1$ over the Weighted Average cost of Capital.

$$\text{Value of Firm} = \sum_{t=1}^{t=\infty} \frac{\text{CF TO FIRM}}{(1 + \text{WACC})^t}$$

Where: $\text{CF to the Firm}_t$ = expected Cash flow to Firm in period t

WACC = Weighted Average Cost of Capital

The critical component here is the ability to correctly forecast "expected cash flows for the firm on a forward-looking basis." The standard ways is to discern information from news releases from the firm as to their projections, derive a model based on past performance, project the discount rate and the risk free rate of return, look at competitive factors such as changes in market share, the relative performance of different divisions within the firm and the relative profit margins and expected growth rates within those divisions. These kinds of calculations in fact are the standard fair for most analysts. Unfortunately, as in the case of Intel past performance and even future expectation did not help explain forward-looking events. Cornell was able to value Intel once they warned, but unlike the market was unable to see the seriousness of the implications for future cash flow for Intel. Four years later Intel is still trading at a 60% discount from the highs of 2000. Some of it clearly is the lower valuations of the entire market, but is this not part of the valuation of an asset phenomenon. Cornell may have perhaps been even more lost than what the market was telling him, after the warning. The market knew that this was no small aberration and priced the stock accordingly. Cornell was still attempting to price the stock based on past performance. There needs to be a clear

distinction between valuation and forecasting. DCF can value an existing asset, a house, a diamond ring, a stock, but ultimately it has to make assumptions about the future based on the past.

Security analysts from each of the major Wall Street firms, each follow approximately 5 to 10 firms intensively. They write reports often monthly on each of the stocks that they follow. These reports emerge from two traditions: (1) fundamental analysis and (2) technical analysis. Technical analysis is often dismissed within academic circles but interestingly the critique of fundamental analysis ultimately is similar to the critique of CAPM models. Fama elegantly and persuasively in an early article contends that: "although there are many different chartist theories, they all make the same basic assumption. That is, they all assume that the past behavior of a security's price is rich in information concerning its future behavior." (Fama 1965 p. 34). Fama is correct to argue that the chartists believe that there are common patterns that occur on a regular basis, and these patterns like support levels, double tops etc, cannot be relied upon. These patterns can be problematic. The irony is that CAPM models, which today are the cornerstone of all evaluation work, similarly have this shortfall.

The Critique of CAPM Models:

CAPM models are dependent upon past price movements staying constant. Most CAPM models attempt to project revenue streams based on expectation that past events serve as a guide for future returns. The difference between the risk free and the risk premium are calculated based on past expectations. Even if you assume that the probability of events like September of 2000 are rare, would it not have been nice to better anticipate this event than to simply say it was an outlier. How far back does one go

back in evaluating the risk and expected return: 6 months, a year, five years, perhaps even twenty years. If one cannot project the future revenue streams other than by using past performance one cannot accurately value an asset, certainly in transition situations.

Highly successful securities analysts, however, generally work from these CAPM models. They begin with the assumption that every asset has a value that can be determined. The problem is that anyone can go to a stock page or the Internet and see what the market price of a company is. Is this a fair price or not depends on their assumption about the future potential revenue stream for that company. The price that someone is willing to pay is the value of the asset or in more formal terms its enterprise value (EV) which is its market capitalization plus debt less cash and cash equivalents. The market capitalization of course is dependent on the expected revenue stream, which in turn depends on the assumptions of past value projected forward.

How do you explain unanticipated events that fall out side of the expected range of anticipated events? CAPM is clearly different than the approach of the chartist but both approaches are critically dependent upon past experience influencing future analysis. Whether one employs a DCF, or DDM model, to project future revenues and income of a company they are primarily assuming continuity with past events. This assumption is endemic to even the more complex approaches of Markowitz and Sharpe's CAPM models where they take the covariance matrix of past returns as a guide to future risk. Fama and French were correct to extend their critique of CAPM models: when they contend: "many of the CAPM average-return anomalies are related" and one cannot explain return anomalies based on CAPM models (FF p. 55 1996), concentrating also on the cross section limitations of the CAPM model.

Campbell, Lo, and Mackinlay, conclude their discussion of CAPM models by stating that:

> We have shown that there is some statistical evidence against the CAPM in the past 30 years of US stock-market data. Despite this evidence, the CAPM remains a widely used tool in finance. There is controversy about how the evidence against the model should be interpreted. Some authors argue that the CAPM should be replaced by multifactor models with several sources of risk. (C, L, M p. 217)… We summarized empirical evidence indicating that the CAPM beta does not completely explain the cross section of expected asset returns. (CLM p 219).

Multi-factor models were an attempt to explain cross section anomalies limitation of the CAPM models.

The Multi-Factor Arbitrage Pricing Theory Factor Approach:

In many ways the work spearheaded by Roll and Ross, Barra, Fama & French, Chen, Blin and Bender are all attempts to fill this gap. There, however, appears to be two very specific objectives. First, Roll and Ross conceptualized this cross section problem with their development of arbitrage pricing theory (APT), which became applied by two groups the Blin and Bender, and Barra. Blin and Bender say the arbitrage and pairs trading possibilities and started called APT. Barra, alternatively, saw the risk and compliance possibilities and developed risk compliance models. Second, beginning with Fama and French, from the academic perspective there was an attempt to understand these cross section anomalies more directly (Fama & French 1992, Chen, Roll, Ross 1991).

The standard APT factor model postulates that a linear relationship exists between the realized returns of the assets and the K factors common to those assets, or

$$\mathbf{R_{it} = E\,(R_i) + \Sigma\, b}_{ik}\ F_{kt} + \epsilon_{it}$$

$k = 1$

Where:

$R_{it}$ denotes the rate of return for asset i;

$E(R_i)$ denotes the expected return for asset I;

$B_{ik}$ denotes the sensitivity (or exposure) of asset i to factor k;

$F_{kt}$ denotes the return of factor k with $E(F_{k)} = 0$; and

$\epsilon$ Denotes the residual (or specific) return of asset I, i.e. the share of the return that is not explained by the factors, with $E(\epsilon_i) = 0$.

The factors k in this regression or difference equation model determine the return to asset, index, sector, or security i. This model then predicts stock prices based on the ability to forecast future unanticipated rates of inflation, production, some have preferred various consumption metrics (Roll, Ross, & Chen).

Roll and Ross originally developed this critique, which is often identified as an arbitrage pricing theory (APT) factor model approach. It is identified with arbitrage theory in that they are attempting to understand cross section anomalies in market or portfolio returns thus creating what may be considered arbitrage possibilities. They argue that CAPM models measure risk on a single number the "asset's beta." They contend that: "an asset's riskiness, its average long-term return, is directly related to its sensitivities to unanticipated changes in four economic variable – (1) inflation, (2) industrial production, (3) risk premiums, and (4) the slope of the term structure of interest rates (Roll & Ross 1984 p.14).

Blin and Bender were one of the early groups to pick up fully on the arbitrage potential and concentrated on risk neutral portfolios attempting to balance away some of

the risk to create an artificially higher portfolio with the characteristics of a risk free portfolio, but with a series of risky assets. They also developed various pairs trading models keying in on this arbitrage of anomalies as developed by Roll and Ross. The Barra group took this enterprise one step further and saw the compliance possibilities with respect to risk evaluations, and have developed a highly successful business around these measures.

Fama and French, from a purely academic perspective pushed the question of anomalies into their now classic article that developed a 3 factor model attempting to explain various cross section anomalies. These factors are: "(1) the excess return on a broad market portfolio; (2) the difference in the return on a portfolio of small stocks and the return on a portfolio of large cap stocks; and (3) the difference between the return on a portfolio of high-book-to market vs. the return of low-book-to-market stocks." (Fama & Frenceh 1996 p. 55). Each of these multi-factor models has a major limitation. None of these approaches are capable of making forward-looking projections.

The Critique of these Multi-Factor Models:

The three groups all working from a slightly different perspective have all emerged from a similar core, a core that itself may contain limitations. Campbell et al, correctly address this critique. They argue that factor models:

> Provide an attractive alternative to the single-factor CAPM, but users of such models should be aware of two serious dangers that arise when factors are chosen to fit existing data without regard to economic theory. First, the models may over fit the data because of data-snooping bias; in this case they will not be able to predict asset returns in the future. Second, the models may capture empirical regularities that are due to market inefficiencies or investor irrationality; in this

> case they may continue to fit the data but they will imply Sharpe ratios for factor portfolios that are too high to be consistent with a reasonable underlying model of market equilibrium (CLM p. 251).

Campbell et al go on to argue that what is needed is: "what forces determine the risk less interest rate (or more generally the rate of return on a zero-beta asset) and the rewards that investors demand for bearing risk?" (CLM p. 291). They go on to argue that:

> In the CAPM the reckless interest rate or zero-beta return and the reward for bearing market risk are exogenous parameters; the model gives no account of where they come from. In the APT the single price of market risk is replaced by a vector of factor risk prices, but again the risk prices are determined outside the model (CLM 291).

As a means toward creating this type of forecasting model Campbell et al go on to develop a consumption based model arguing that consumption and preferences leads the stock returns. They even go on to an example where commercial paper index growth leads the sectors index growth. They go on to contend that there is: "strong evidence that the real commercial paper rate is forecastable, and weaker evidence that the real stock return is forecastable" (Campbell p. 313). Is this not what Kumar really did with Semiconductor shipments and the new order data, and can we go beyond the single variable forecasting model and go into a multi-dimensional forecasting framework.

By taking the factor model approach and using data available to specific sub sectors of the economy one can use the sub sector data as the independent variables and build forecasting models by sub sector. While Roll and Ross used inflation and industrial production, suppose we looked at ppi for semiconductors, shipments and new orders for semiconductors, labor force and hours worked by semiconductor worker when attempting to understand the semiconductor sector. This study will use the factor model approach attempting to extent Chen, Roll and Ross to asset forecasting. This will be attempted by

using information that is often neglected by the Wall Street securities analyst, while challenging also the central assumption of the efficient market hypothesis. It will strive to establish that information distortions exist, and the primary explanation may well be found in the biases of approaches used by the Wall Street Analysis's.

## FINANCIAL FORECASTING

The starting point for many when thinking about forecasting are the models and tools utilized by the conference board in forecasting the GDP of the economy. One of the problems encountered with these measures is that the objective of the conference board and those of the finance community are rather different. The conference board in their projections in fact even uses as one of their primary measures the S & P 500 stock index, under the presumption that the index itself is a leading indicator. How then can one use the leading economic index as a measure of stock prices? This takes us to the very heart of the issue between financial forecasting and economic forecasting. The objective of course is financial forecasting and attempting to project the market and the economy, two very different activities. (Miemira).

Economists have been using Governmental economic data since their inception. They have even been at the forefront in the development of the data collection process. Most economists, however, rarely use the data to the full extent of its current availability. Economists are concerned with national economic trends and to lesser extent differential growth patterns of sectors such as manufacturing, financials, technology, and commodity prices. However, they rarely utilize the information at the level of the sub-sector.

Analysts alternatively concentrate on data from firms like accounting data, news releases, competitor's behavior, and the like. Their use of economic data from government reports is similar to that of the economist, to determine trends in the overall economy. Neither the economist nor the analyst appears to drills down into this data to develop forecasts at the level of the sub-sector.

In order for the government to collect the GDP data at the macro level, they must first collect this data at a micro level. This is why the census department, a division of The Department of Commerce, collects so much of the economic data. The Census department has created over 40 single spaced pages of sub categories of business activity. They have coded each of these business activities into a 6 digit NAICS code. Each company can be assigned a single or multiple 6-digit codes. This data in turn is reported by significant sub sector, such as: iron and steel, semiconductors, computers, aluminum, heating and ventilation, department stores, etc, etc. This data is collected for new orders, sales, inventories, at the manufacturing level; sales, and inventories at the retail and wholesale level, ppi, cpi by sub-sector; hours worked by sub-sector and number of workers by employed by sub-sector; as well as capacity utilization by sub-sector. The data comes out monthly, and is approximately 5 weeks late, but earnings are often are reported 8 weeks after the first monthly report of the sub-sector, giving the analyst enough time to anticipate problems within a given sub-sector way before earning warning begin.

All U.S. companies are classified by six digit North American Industry Classification System Code (NAICS), created by the Census. The Departments of

Commerce, Labor and the Federal Reserve use these classifications when reporting their monthly economic statistics. For example:

Sectors and Companies by NAICS codes:

| Code | Sub-Sector | Company by Stock Symbol |
|---|---|---|
| 337310 | - Semiconductors | - intc, stm, mxim |
| 334112 | - Computer storage Device Manufacturing | - emc, stx, sndk |
| 321991 | - Wood Building and Mobil Home Mgf. | - gp, sky, chb, lpx |
| 333111 | - Farm Machinery and Equipment Mgf. | - de, ag, lnn. |

Each of the S& P 500, 400 Mid Cap, and 600 Small Cap, has a 6 digit code that corresponds to the government data. The data in question covers over 50% of the companies in these indices giving analysts the ability to follow raw data of sales, inventory, employment data from real numbers as opposed to projections from prior cash flows. In fact, it is strongly encouraged that this data be used to forecast the unknown in the DCF models once there is a sufficient deviation from the expected morn from this sub-sector economic data. If we have the risk, and the beta's for the APT model, and the government provides us with the factors, i.e. shipments, new orders, employment, retail, wholesale sales, by sub-sector, can we not then better project cash flows for the period $t_1$. This would give the analyst a confirming or divergent projection for their standard projections, or to even confirm the information given by the company, which is forward looking. As noted in the case of the semiconductor industry they were still hiring well past the time that a slowdown was apparent. This being a possible indication that the company itself was surprised by the rapidity of the downturn, with the CEO of Intel on

September 25th saying: "we didn't see this…our job is to minimize the surprises on people." (Austin American-Statesman).

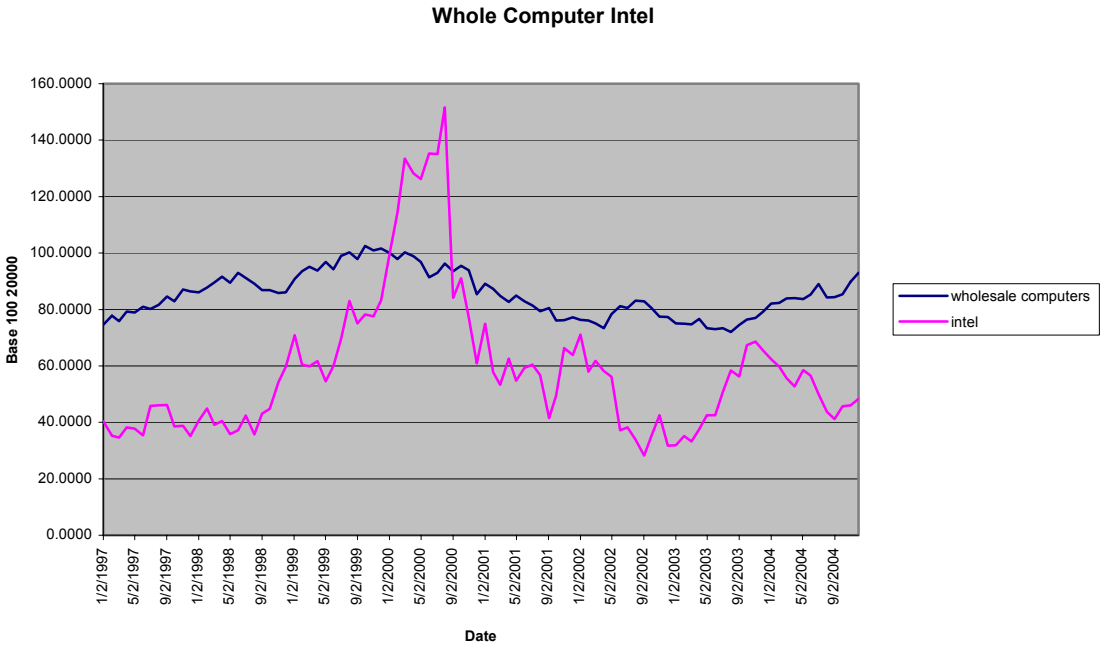
## KUMARS APPROACH – USING AVAILABLE GOVERNMENTAL DATA

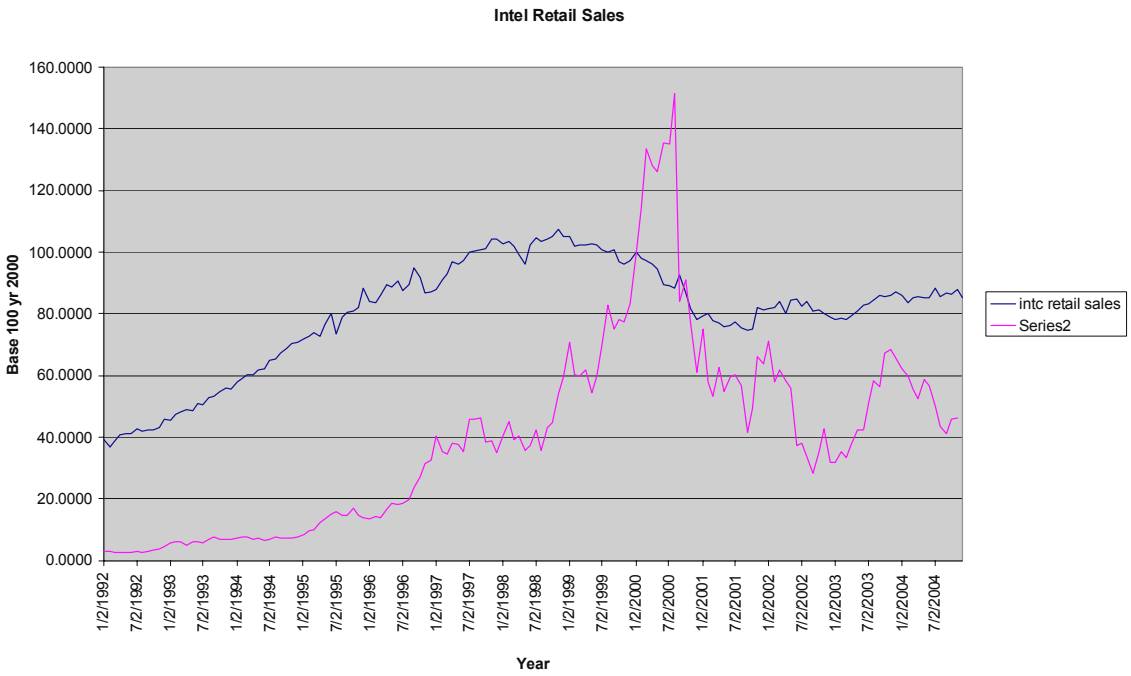
Kumar anticipated that Intel might not meet its projections. On September 5th 15 days before the Intel warning he noted demand weakness, seasonal recovery disappointing, oversupply, poor pricing environment. September 5th was a Tuesday following a long Labor Day weekend. On August 29th exactly one week before he had reiterated his price target of $90 a share and a strong buy on Intel noting that they were encountering some production problems with their "flagship 1.13 GHz Pentium III processor.

Intel in 2000 was primarily a "semiconductor chipmaker, supplying advanced technology solutions for the computing and communications industries. Intel's products include microprocessors; chipsets; motherboards; flash memory; communications infrastructure components, including network and embedded processors; wired and wireless connectivity products; products for networked storage; application processors, and cellular base band chipsets" (Yahoo profile). In the year 2000 80.6% of their revenues came from their Architecture Group whose products include microprocessors, motherboards, and other related board level products, including chipsets (10Q 11/2000). Eighty percent of their revenues then in the year 2000 came from computer related products, for which they were the preeminent chipmaker.

The obvious places to look to determine if their expected 17% growth rate was a good estimate would be to look at manufacturing shipments of semiconductors, and

computers, inventories of semiconductors, computers and new orders. It may also be informative to ask what was happening with retail and wholesale sales and inventories of computers. A quick look at retail sales of computers, clearly indicates that from January of 2000 computer retail sales were down as much as 20 percent. Wholesale sales were down 10% and inventories of retail and wholesale computer were rising. (Chart 1, 2)






From the above tables and description it should be clear that Kumar clearly saw a possible emerging trend that clearly contradicted conventional knowledge. We observed that after August 28th Kumar observed the new data released by the government, and it was with this data in hand that he reasoned that a three-month clear counter trend had emerged. Having observed this he did what any reasonably capable analyst would then do. He went to his contacts or as he has identified them as the semiconductor food chain and directly questioned whether these government trends made sense with them. When he confirmed these trends, he made the call that Intel's projections may be somewhat lighter than the street had expected.

## RATIONAL EXPECTATIONS FORECASTING

The objective of this section is to formulize what Kumar accomplished by intuition, experience, and contacts into a more formal model of security pricing. To

restate the problem we are trying to understand what Grinold said are the "building blocks of alpha." (Grinold p. 10). Alpha is conventionally defined as the "average realized residual returns" or more precisely realized alpha. What we are looking for are expected Alpha or future returns. We are then really attempting to solve a difference equation in the form of:

$$\Delta y_t = y_{t+1} - y_t$$

with the desire to forecast $\Delta Y_t$ or in other terms expected alpha.

Many groups have attempted to forecast stock market returns. One group that has some prominence is that of Kristiansen, Niemira, and McCormack for Pain Webber in 1987 when they built a forecasting model for the auto sector. Steve Gersky at Morgan Stanley who was part of that group still uses a variation of this model today. Their model was somewhat simple using home sales, consumer confidence, federal funds rates, and debt payments placed in an index and showing mostly graphically that it leads auto sales (Niemira p. 361). Can a model of this nature be formalized and if so can we build a better consumption model than Campbell et al envisioned, sector by sector using factor analysis to create the variable that explain the $\Delta P$ of the sector. Each sector has all kind of data that we can pool from to determining the change from time t to $t_{+1}$.

The first step in the process is to identify a sector. There are two choices one can create your own sector or one can use the Reuters or the Gic sectors. This of course can be accomplished by using some form of cap-weighted system or a simple average weighted system. Assuming the sector is defined one begins with the standard factor model and in this instance treats the semiconductor sector as the dependent variable, and in the most simplified form using the following multi-factor model:

$$R = a + bx_1 + bx_2 \ldots\ldots + bx_n + e$$

Where:

R = Monthly returns for the semiconductor sector

$X_1$ = Semiconductor shipments

$X_2$ = Semiconductor new orders

$X_n$ = Semiconductor Inventories

= Average workweek semiconductor industry

= Any other applicable factor

Once the desired factors are derived using a stepwise method and selecting only those variables that have explanatory value and appear interesting.

Once these factors are identified the real work must begin. The more that can be understood about the sector the better. There are four obvious elements that must be dealt with: (1) leads and lags, and interdependent relationships (2) seasonality, and (3) volatility (4) comparative expectation. Having specified the simplest form of the stochastic model complicating issues emerge immediately.

Leads and lags and Interdependent Variable:

The most obvious issue is lagging the data to coincide with the delay in the governmental releases. The March 30 data on shipments for example does not come out until May 3, which means that there is at least a 4-½ week lag. Since new orders are considered a leading indicator and shipments are considered a concurrent indicator, are these reflected in the stock price at the same time? Other issues come up with respect to inventory, for example, and does it have a relationship to shipments. If there is an

inventory buildup or shortfall how are shipments affected, and what are the cross section relationships for explaining these differential inventory needs. Are there differences when there is greater shipment volatility and how does that affect normal inventory stocking? . Can one reasonably deal with buildups based on seasonal expectations based on the manufacture whole leads and lags?

Seasonality:

There are many questions with respect to seasonality beginning with how one uses the seasonal adjustments of the government or does one create their own measures. How does the market respond to the difference between non seasonal movements that are muted by seasonal smoothing. and how fine are these distinctions? How does one adjust for year over year analysis as opposed to sequential impact? There is ample evidence that since seasonality is a real issue for a growing company that the first difference with respect to sequential changes are often muted by year over year trends.

Volatility:

Volatility is another import are area of difficulty getting to the heart of the question of expected and actual consumption, and how significant are big unexpected changes as opposed to more minor variation. How does one-treat periods of greater volatility in these factors and what effect can be expected on the price of the asset that is more volatile? . The process here would be to follow the work of Engel and apply some form of Autoregressive Conditionally Heteroskedastic (ARCH) model for this volatility measure. Using ARCH processes setting the mean to zero while concentrating on the variance leads to a whole host of interesting possibilities that are different for each sector.

Comparative expectations:

Once all the seasonal factors are understood and the relative projections are made from the expected to the actual, it would be interesting to compare this data to the expectations from the street and see if any of this makes any sense in relation to the growth of the sector. There should be a clear relationship here, to projected revenues. Once deviations from the expected are found then it would interesting to gage the difference from the mean with some form of volatility measure, always recognizing that the greater the volatility the greater the risk factor and similarly the greater the expected return would be the greater movement with either sign.

## SECTOR INDICATORS

The ultimate goal is perhaps two fold: (1) to build very careful sectors and work to really understand the movements within this sector relative to the entire economy, and (2) once each of these 60 to 70 sectors are developed and understood it would appear desirable to build an index sector by sector much like the leading concurrent and lagging indicators as developed by the conference board, but in this case create not 3 indicators but a single indicator for each sector thus totaling between 60 and 70 indicators.

This however, is not to say that a great deal of information cannot be gained about relative differentials simply from the shipment data, the new order data, and the inventory data to begin to work on a relative strength model. If one begins here I would suggest that this work begin with some of the sector work and try to find the two approach somewhere in the middle.

# CONCLUSION

Was there information in September of 2000 that was not fully utilized by analysts with respect the economic conditions confronting Intel? This was clearly the intent of this paper to demonstrate that in fact underutilized information did exist, despite the fact that Intel in the year 2000 was one of the most heavily followed company in the world. What, then, does this say about the strong and semi strong efficient market hypothesis? Certainly at one point in the history of Intel Corporation there was information available that could have helped price the stock in a more complete manner, which may have reduced the extreme market volatility that occurred in September of 2000. It certainly would not have prevented the decline in the stock, but perhaps it could have prevented some of the up side over exuberance, or at least facilitated a more orderly decline.

With respect to the limitations with CAPM models, it clearly indicated that in the extremes there are probably serious limitations. The paper used one example and showed that in an extreme situations a modified APT factor model does have very promising potential. This paper has not established whether the model will work for more minor transition and inflection points within sectors, but preliminary results have been very positive. More research still needs to be done to definitively prove the value of this proposed model.

The question that remains unexplained is why after this catastrophe are more analysts not seeking out this kind of data. This I cannot fully explain. They all knew that Kumar made an incredible call on Intel in early September of 2000. A major reversal call at a time when the sky was the limit must have been noticed. Everyone must have noticed

the awards that Kumar received for this call. What I cannot explain simply is why after these events have so few analysts looked to this approach. In discussions with Edelston's staff they have treated inquiries with various degrees of contempt, stating that they do not do their analysis, the way suggested by APT modeling. I cannot blame them for their view, because they are very high priced analyst's working diligently from a perspective with certain embedded assumptions, and they probably do not even today fully realize the limitations of these assumptions. Is this then the real explanation, that the real blame may well rest in the slow progression from the classroom to the boardroom, must it really take 20 years for the knowledge to filter down. The critiques of CAPM models have been available for at least a decade, but it appears that few analysts on Wall Street have taken notice. We all know the limitations, but can we get past them. Two hundred and fifty billions dollars is still a great deal of money to see disappear in less than a month. It simply went away.