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A Behavioural Finance Explanation of a Gearing-β Inverse Association Referencing Weill's Liquidity Result

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1. Introduction

Beta (β) of the Sharpe (1964) and Lintner (1965) Capital Asset Pricing Model (CAPM) has, over the years, been used for judging organisational performance. As Harrington (1983, p. 157) notes in the *Harvard Business Review*: "One way to quantify financial risk is via the capital asset pricing model, which describes the way stock markets establish prices, which in turn establish the returns on corporate capital investment."

Harrington then describes the way that Alaska Interstate, Inc. used β to made decisions about the direction that the company should take to better manage their return relative to risk. Also see, Beneda (2003) who discusses the use of β in determining the cost of capital and the use of that information for deciding about changing the asset/project base of the organisation. These two examples, underscore the following fundamental economic imperative: It is in the best interest of the firm to manage their return/risk relationship because (1) the more the market relative risk the more the organisation is expected to return, and (2) the nature of the return-relative--to-risk relationship impacts the interest rate that the firm can negotiate in the long-term capital market as well as the amount that is needed to be committed for the payment of dividends (Brealey – Myers – Allen, 2006, pp. 418–421). For these reasons, there has been considerable interest in examining this simple regression multiplier to determine what seem to be drivers of β – i.e., the variables over which management has control which in turn affect β.

Arnold (2002, p. 741) identifies the following two factors as drivers for the return/risk relationship:

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1. ***Degree of operating gearing.*** If a firm has high fixed costs compared with variable costs of production its profits are highly sensitive to output levels. [...] The higher variability in profit means that a higher beta should be allocated.
2. ***Degree of financial gearing.*** If the company has high borrowings, with a concomitant requirement to pay interest regularly, then profits attributable to shareholders are likely to be more vulnerable to shocks. So the beta will rise if the company has higher financial gearing (or leverage).

The implication of Arnold's conjectures is clear. Considering the classical theoretical underpinnings of the return/risk relationship, he suggests that Operating and Financial gearing should be positive "drivers" for β. This then is the motivation of our study. We address the question: Are the positive relationships suggested respecting operating and financial gearing, as they relate to β, reliable decision information for those seeking to manage the firm's return/risk relationship by managing β through these gearing variables?

2. Study

To examine the relationship of Operating Gearing and Financial Gearing to β, we have selected as the measurement surrogate for operating gearing the ratio of net Property, Plant and Equipment to Total Assets (PPE/TA), or what Weill (2004) terms Tangibility, and for financial gearing, we will use the ratio of Long-Term Debt to Stockholder's Equity (LTD/E) which is the usual definition of leverage. Consider now the study sampling frame, time periods, accrual criteria and data sources.

The Study Sampling Frame: It has been recognised for some 30 years that firm size and relative value interact with β and that the nature of that interaction has been changing over time (Fama – MacBeth, 1973), (Beneda, 2003). So that we could focus most clearly on the effects of gearing on β, we wanted to find a sampling frame where β would not be differentially affected by firm size and value. This was the same issue that Fama and French (1993) faced in developing their three-factor model. Therefore, in considering the traditional one-factor model using the S&P 500 or the three-factor model, one parameter of which is the comparable equity β, we selected the one-factor model because (1) recent sensitivity analyses reported by Hendricks and Singhal (2001) on the S&P 500 as it relates to the one- and three-factor models as benchmarks suggest that either can be usefully employed in understanding long-run stock price performance, and (2) the equity β of the one-factor model is the traditional benchmark and is simple to interpret in that it contains all the multiplier information. Finally, because β may be changing over time, we selected firms that have been on the S&P 500 continually for a long period of time so that we could focus most clearly on effects of the gearing variables on β by controlling for the time frame. Consider now the selected time periods.

The Time Periods: Our analysis uses market and firm data from the beginning of 1985 until the end of 2002. During this time period, the following three major events have affected the commercial world: (1) worldwide

linking of country intranets as the World Wide Web circa 1993, (2) the market implications of Enron's collapse, started by Jeff Skilling's unexpected resignation due to "personal reasons" on 15 August 2001; and (3) the terrorist attack on 11 September 2001 resulting in the collapse of the twin towers of the World Trade Center. To control for the economic shocks that these events created, we divided the time span of our study into three periods: Pre-Internet (1985–1992), Internet (1993–August 2001), and Post-Enron and 9/11(September 2001–2002), noted as Post-9/11. These time periods also give a reasonable time frame for the measurement of β, which according to Ibbotson Associates, Compustat™ and Value Line™, is often based on at least a five-year period. Our study, then, can speak most clearly to the question of β associations for the two gearing variables for the first two time periods; the third time period, Post-9/11 which spans only 16 months, is offered as exploratory information.

A caveat here is appropriate. Many events have dramatically affected all major indices – e.g., the S&P 500, the NASDAQ, and the NYSE – and possibly have affected them differentially depending upon their sectoral constitution. In our analysis, we have aggregated over all the various sectors that in total constitute our market index. Here, as further research, a within-index major sector analysis is suggested to examine if benchmarking on particular sectors within the market index may refine our over-sector results. See Khorana and Nelling (1997) who do this sector screening for the S&P 500 and determine, not surprisingly, that sometimes sectors are important analytic partitions. Also see (Ibbotson Associates, 2004, p. 100).

Accrual Criteria: We have selected as the sample of organisations those that satisfied all the following three criteria:

1. They were on the S&P 500 continuously from 1 January 1985 until 31 December 2002.
2. They had quarterly, downloadable gearing performance information.
3. They had not undergone a redefinition of line-of-business, nor merged nor partnered that resulted in a change in their stock listing symbol.

Of the 165 organisations for which complete market data was available, 22 organisations satisfied the first two accrual criteria, but were eliminated owing to the third. We used the third criterion to focus our analysis on the "same" organisation. We assumed that stock listing symbol changes would, at minimum, induce some perturbation in β compared to organisations that maintained the same symbol. For example, Monsanto was eliminated from the study because Pharmacia and Upjohn merged with Monsanto in 2000, at which time Monsanto's symbol changed from MTC to MON. Further, because β is expressed through the OLS linear one-factor regression model, one must be attentive to the assumptions underlying this regression model. Here we used, as a model adequacy check, the Fisher's Kappa's *p*-value of the residuals generated by the linear regression. Any company for which the Fisher's Kappa's *p*-value was less than 0.01, indicating that the linear fit left important structure in the residuals and so β was not well estimated, was eliminated from the study. Nine companies were eliminated for this reason. Further, for each of the three time periods, we eliminated any firms which, for that time period, had on average negative equity. We view negative equity as an exceptional event, not in the general spirit of the fi-

nancial gearing that we are interested in studying. This resulted in no more than two organisations being eliminated for any particular time period. Finally, because we are examining the correlation of β, PPE/TA and LTD/E, we screened out any organisations that were identified as Malhalanobis outliers due to the possible skewing effect such "correlation" outliers can have on the estimation of β (Sall – Creighton – Lehman, 2005). This resulted in the following number of organisations in the final samples: Pre-Internet [n = 129], Internet [n = 129] and Post-9/11 [n = 124].

We tested if there was bias in these eliminations by examining the study organisations compared to approximately 35 organisations eliminated on: Total Sales as well as their Fortune 500 rank. For both variables, there were no statistically significant differences between the two groups at a p-value < 0.1. Also, for the Fortune 500 rank, the 95-percent confidence interval for both groups contained 250. This information suggests that was no systematic bias in the firms eliminated.

Data Sources: We collected through the Wharton Research Data Services (WRDS™) the following information:

1. From the Center for Research in Securities Prices (CRSP™), we collected daily return information from 1 January 1985 to 31 December 2002 for the study organisations, and time-matched S&P 500 value-weighted returns, our market surrogate.
2. From Compustat™, we collected quarterly Net Property Plant and Equipment (PPE), Total Assets (TA), Long Term Debt (LTD) and Equity (E), Current Assets (CA), Current Liabilities (CL), Net Operating Profit after Taxes (NOPAT), and Earnings per Share (EPS).

3. Results

Sample Credibility Check: Here we want to give three expectations for β as a credibility check on the sample of organisations relative to the sampling frame:

1. For organisations with more than 15 years of continuous representation on the S&P 500 index, we expect that they would have, on average, β less than 1, the assumed market β. This expectation seems reasonable given the distributions of β reported by BVD: OSIRIS™ where the average β for all the firms on the NYSE for 2004 was 1.04.
2. One would expect that β for the Internet period would be lower than β for the Pre-Internet period. This is due to the rapidly increasing index value added by the newly created "sector" of Internet companies, sometimes referred to as the *dot.com bubble*. In comparison, the stocks of our sample would have lost some of their multiplier value due to their lack of systematic co-variation with the dot.com sector (Eleswarapu – Reinganum, 2004).
3. Also, we expect that the correlation of β at the firm level would be statistically significant on a period-by-period basis. This is due to the nature of the firms in our sample which are relatively stable in that they are long-term members of the S&P 500 and so one would be surprised if there were no association on a period by period basis.

Consider now the study results relative to these expectations.

TABLE 1 β Profiles for the Three Study Time Periods

Study variables	Pre-Internet (*n* =129)	Internet (*n* =129)	Post-9/11 (*n* = 124)
Mean (Median)	0.74 (0.78)	0.52 (0.53)	0.68 (0.71)
Range (St. Dev.)	0.22 to 1.23 (0.22)	0.22 to 0.98 (0.16)	0.26 to 1.30 (0.22)

TABLE 2 β Period Multivariate Correlations: Pearson (Spearman)

	Pre-Internet	Internet
Internet	0.63(0.56)	–
Post-9/11	0.39(0.35)	0.78(0.77)

The Distributions of β over the three time periods are presented in *Table 1*.

All of the 95-percent confidence intervals for β exclude 1.0, suggesting that for each time period, this population of firms has a β of less than 1.0. Using the Tukey-Kramer HSD multiple comparison test, here a conservative test of our second expectation, we find that all of the three means are statistically different from each other at $\alpha = 0.05$. Therefore, our expectation that β for the Internet period would be lower than β for the Pre-Internet period is borne out by the data. In Table 1 we have presented both means and medians, subsequently, we will present medians and use, for purposes of inference, the Median test that conserves sample size in the presence of outliers that were in evidence for some of financial performance data.

As for the third expectation, the results are presented in *Table 2*. The *p*-values for these correlations, considering the null, are all less than 0.0001 suggesting that the firm βs are indeed associated over time. Also, the lowest pair-wise correlation is for the Pre-Internet with the Post-9/11 suggesting that the association between the two temporal extremes is the lowest which is not unexpected. In Table 2, we presented both Pearson and Spearman correlation coefficients; subsequently, to present conservatively the associational results, we will use the Spearman correlation coefficients and the related *p*-values. Finally, for informational purposes, we wish to note that the correlation of the PPE/TA with LTD/E was positive and statistically significant $p < 0.0001$ as was the case for almost all of the studies that we reviewed. For an excellent summary of studies that report on this relationship, see (Weill, 2004).

Tables 1 and 2 and the testing information of the three expectations argue that the data relationships for β seem reasonable for the organisations in our sampling frame, suggesting that our sampled firms may provide reliable information respecting the β-driver analysis. Consider now the β-Gearing relationships.

4. Gearing and Arnold's Conjecture: β as It Relates to PPE/TA and LTD/E

Considering Arnold's expectations, we hypothesize that the correlation of β with the two gearing variables would be positive for each of the three time periods. These results are presented in *Tables 3* and *4*.

TABLE 3 Correlations of β with Operating Gearing by Period

Time Periods	β with PPE/TA	*p*-value
Pre-Internet	–0.22	0.0110
Internet	–0.51	< 0.0001
Post-9/11	–0.34	< 0.0001

TABLE 4 Correlations of β with Financial Gearing by Period

Time Periods	β with LTD/E	*p*-value
Pre-Internet	–0.24	0.006
Internet	–0.29	0.0014
Post-9/11	–0.18	0.0451

The results are clear; the correlations of β with the two gearing variables are consistently negative meaning that one may reject Arnold's conjecture that β is positively associated with Operating and Financial Gearing. We call these the *Gearing Inversions*.

Discussion: These Gearing Inversions, where β is negatively associated with Operating and Financial Gearing, work against the accepted theory as expressed by Arnold's conjecture that is founded on the Markowitz (1952) assumptions regarding the trade-off between return and risk where gearing would be positively associated with β. However, these gearing inversions that we have identified are not a complete surprise and do have economic precedent. Ibbotson Associates (2004), for example, reports that for the telecommunications industry during the 1990s, there was also evidence of such a β-financial gearing inversion. They note: "The lower debt-to-total--capital ratios indicate that there is less leverage and therefore less financial risk. All else held constant, one would expect the levered beta to fall, given a reduction in leverage. However, we observed the opposite for the telecommunications industry in the 1990s." (p. 100)

This underscores the importance of also considering the possibility that such effects may vary over sectors as discussed above. We now consider the Gearing Inversions reported in Tables 3 and 4, to examine, in detail, what may underlie them and how that may help place Arnold's conjecture in context.

5. Financial Profiling of the Inversion Groups

In examining these unexpected inversions, we noticed the similarity of our results to that of Weill's study of transitional economies in which he measured a leverage inversion with respect to financial gearing. After regressing Leverage with several variables, one of which was Tangibility, Weill observed that: "The coefficient for *Tangibility* is significantly negative for all countries. This relationship appears surprising since the role of collateral value is expected to be of the utmost importance in transition countries where banks exert special care to secure loans. This argument could

TABLE 5 Financial Profiles for the Inversion Groups

Groups	ß	*p*-value	CR	*p*-value	NOPAT	*p*-value	EPS	*p*-value
LowβHighGearing	0.39	–	0.86	–	1,276	–	2.3	
HighβLowGearing	0.74	<0.0001	1.48	<0.0001	970	0.62	2.1	0.62

however not be relevant for transition countries, as it ignores two features of these economies. First, the enforcement of the law in case of bankruptcy and liquidation is less efficient in transition countries than in Western countries. [...] Secondly, as suggested by Hussain and Nivorozhkin (1997), lenders in transition countries are particularly risk-adverse and may then attach great importance to liquidity. As a result, the share of current assets in total assets should be positively valued, leading to a negative relationship between tangibility and leverage." (p. 240)

To examine this liquidity perspective as a way to understand these unexpected β-Gearing Inversions, we partitioned the sample using median--splits as follows:

For each of the three time periods, we grouped the firms into one of the following two inversion groups: Organisations with a low β and with high operating and high financial gearing. Note this median-split group as (LowβHighGearing). The group with a high β and low operating and low financial gearing is noted as (HighβLowGearing). There were 21 organisations in the (LowβHighGearing) group and 29 organisations in the (HighβLowGearing) group.

We reason that this partitioning will give the clearest information for judging the nature of the β-Gearing Inversion because each group is uniquely categorized based upon the gearing inversion – i.e. they are, for our sample, the purest representative profile of the gearing inversion. We then collected, for these organisations, the following information from Compustat™ for the three periods of the study: the Current Ratio (CR), Net Operating Profit After Taxes (in millions) (NOPAT) and Earnings per Share (EPS). In a preliminary analysis, we observed that the financial profiles of the two inversion groups were not different over the three periods, i.e., the median level differences and the corresponding *p*-values for the financial profiles were the same for each of the three periods. Therefore, we will report the period-combined results in *Table 5*.

Results: We see that the only statistically significant difference between the LowβHighGearing and HighβLowGearing groups is for the Current Ratio (CR). Note that the β information is not a result; it is an artefact of the way the gearing groups were formed.

Discussion: Table 5 suggests that there is a strong positive relationship between β and Liquidity as expressed through the median relationships for the Current Ratio. This β-liquidity relationship is also unexpected or surprising in the following sense. According to the standard return/risk relationships upon which the CAPM is founded, gearing and β should be positively associated – i.e., more gearing results in less flexibility thus resulting in a higher relative risk to return as measured by β. This reasoning extends also to the β-liquidity relationships as follows. One would

theorize that β would be indirectly associated with the current ratio, our surrogate for liquidity, because increased liquidity, should give to the organisation more flexibility to take actions in the short run and so result in a lower β compared to organisations with a less flexible operating profile – i.e., more liquidity suggests more flexibility and so results in a lower β. Therefore in the standard theory there should be an inverse relationship between liquidity and β. So working either from gearing or liquidity, in theory, one expects β to be positively associated with gearing and inversely associated with liquidity. We find the opposite results for both: From Table 5, relative to the median relationships for the two gearing groups, we measure an unexpected strong positive β-CR relationship. In fact, the correlations of β with CR for each of the three periods were 0.5, 0.6, and 0.6 each of which has p-values < 0.0001. Further, from Table 5, we see that NOPAT and EPS are not different between the gearing groups, suggesting that the anomalous inversion effect is isolated on liquidity as a possible instrumental association with β. An explanation of these unexpected results may be argued from a behavioural finance perspective (Kahneman – Riepe, 1998), (Shiller, 2003), (Ackert – Church – Deaves, 2003). This is essentially what Weill does to explain his "surprising" result.

6. A Behavioural Finance Possibility

For our study, the inverse relationships of operating and financial gearing with β could lie in the way that liquidity is perceived by those in the market and not with the Markowitz return/risk relationship that would have β being positively associated with gearing – i.e., theoretically more gearing and so less liquidity would result in more risk – i.e. a higher β and *vice versa*. Perhaps high liquidity suggests to investors that they should expect/require more return; these high liquidity organisations may seem to have great potential to react as well as to be pro-active in the complicated and dynamic globalized markets and so the shares of these companies may take on the aura of glamour securities (Ciccone – Rocco, 2005).

Arnold (2002, p. 621) suggests that the behavioural aura of glamour companies may result in increased variance of expected returns and also a mollification of these expectations for the not-so-glamorous companies. He says: "The problem is that the market apparently consistently overprices the 'glamour' stocks and goes too far in assigning a high price earnings ratio because of overemphasis on recent performance, while excessively depressing the share prices of companies with low recent earnings growth." Also see (La Porta – Lakonishok – Shleifer – Vishny, 1997).

Therefore, high-liquidity organisations with a glamour aura may be expected to have higher returns than organisations with lower liquidity producing higher volatility, so β moves positively with liquidity due to the glamour-aura and not inversely as return/risk theory would suggest; and, we know that gearing is practically inversely related to liquidity resulting in the inverse relationship that we measure for gearing and β (Eleswarapu – Reinganum, 2004).

7. Conclusion

We learn from Weill's study of transition economies, that liquidity might be a key economic hedge given the dynamic, uncertain and evolving markets. Actually, the need for liquidity as a flexibility-hedge is what we now see in the globalized markets. Starting in the mid 1980s, in attempts to guard liquidity, organisations have downsized, outsourced and currently are partnering and venturing in low-salary-zones as the "en vogue moyen de survivre" (Dominique, 1999). Therefore, perhaps now and for the foreseeable future, companies are like the transition countries in that they are facing dynamic uncertainty in the fast-evolving global markets where a key driver for survival is liquidity. This would argue for firms, in general, to take care to manage liquidity – a survival necessity – and insofar as they need to manage their return/risk profile expressed through β, organisations must manage their public image so as to downplay their possibility of being thought of as glamour stocks because the glamour image may work against the economic logic of having higher liquidity!

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SUMMARY

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The authors investigated Arnold's conjecture that Leverage (Financial Gearing) and Operating Gearing should be positively related to the equity β of the Sharpe/Lintner CAPM. They find for a sample of the S&P 500 firms that have been on that index continuously for more than 15 years, that β is negatively associated with Leverage and Operating Gearing. Using Weill's results for transitional economies, the authors suggest that liquidity may provide an explanation for this anomalous β-Gearing inversion. The implications are: (1) that one should revaluate the positive associations posited for Financial and Operating gearing with β and (2) consider the possibility of managing liquidity as a way to affect β.