VOLATILITY AND THE COST OF CAPITAL IN THE TRANSPORTATION SECTOR

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Introduction

The 2008 calendar year was a difficult year for all aspects of the economy. Prices of natural resources, asset values and exchange rates continued to experience large fluctuations throughout the year, with the trend continuing in 2009. Activities that involved planning for the future, such as supplying goods and services for anticipated demand or planning for retirement, have become increasingly difficult in this environment.

Transportation is not immune to this problem. While carriers have improved their ability to forecast demand at given output prices, the volatility of input prices has made it difficult to determine the optimal level of supply. For example, an air carrier may have a good forecast of the demand for seat-kilometres in a particular market segment at various output prices. However, the profitable output price will be determined in part by the input prices faced by the carrier at the time that those resources are purchased. While some costs such as labour and capital costs can be determined with reasonable certainty well in advance, other costs such as fuel costs are more difficult to predict. Basing output prices for future flights on the current price of fuel runs the risk of operating flights at significant losses, even if demand forecasts were accurate.

[1] The views presented do not necessarily reflect those of Transport Canada.

Volatility in currency prices can also create difficulties for carriers. For Canadian trucking carriers that operate transborder services, many costs are often denominated in Canadian dollars while revenues are often received in US dollars. Appreciation in the Canadian currency can significantly cut into or eliminate the already razor thin operating margins in the industry.

As a result, carriers have put even more effort into mitigating the impact of this volatility through the use of hedging instruments or through the use of fuel surcharges. The extent to which these efforts have been successful should have an impact on the perceived risks of their business in the eyes of investors.

Investors can perceive risk in a number of different ways, but it is generally accepted that higher risks require the promise of higher potential rewards, meaning a higher cost of capital for those businesses. This paper examines absolute levels and recent changes in the stock beta – a key input in the Capital Asset Pricing Model[2] – of a number of transportation carriers since 2007 as an indication of how risky transportation investment may be relative to that of other industries. The Economic Analysis directorate at Transport Canada has begun tracking stock betas as part of a Quarterly Transportation Bulletin and these time series will serve as the main data source.

The Concept of Risk

Financial analysts use the cost of capital of firms in order to discount expected future cash flows to a present value, which in turn represents an estimate of the firm's value. There are several methods that could be used in order to value the equity portion of the firm's cost of capital. One of these methods is the above-mentioned Capital Asset Pricing Model (CAPM). The Build-Up approach and the Dividend Discount Model are other methods used in order to determine the equity portion of the cost of capital.

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[2] See Sharpe, William F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*, Journal of Finance

A key input into the CAPM is the stock's beta (when the firm is a publicly-traded company). The product of the beta and an estimate of the market risk premium is added to the risk-free rate in order to obtain an estimate of the cost of equity.

Cost of Equity (R_E) = Risk-free rate (R_f) + Beta (B) x [Historical market risk premium ($R_M - R_{f*}$)]

A government bond rate is usually used in place of the risk-free rate (R_f), while the historical market risk premium can be calculated by the difference between the average risk-free rate (R_{f*}) and actual market returns over that time. Long-term US Treasury notes are now yielding in the range of 3 to 3.5 percent, while estimates for the historical market risk premium generally fall in the 4 to 5 percent range. Using these figures the 'average' after-tax cost of equity would be approximately 8 percent.

The beta is a measure of "systematic risk", defined as volatility correlated with volatility of the market in general. The beta itself is measured by dividing the covariance of the stock's returns against the market's returns by the variance of the market's returns. A common proxy for the market portfolio is the S&P 500 index.

$$\text{Beta (B)} = \frac{\text{Cov}(R_s, R_m)}{\text{Var}(R_m)}$$

According to the model, investors (who are risk-averse) place a premium on stocks that change in value in different directions than other stocks (or more broadly, other assets) in general, while stocks exhibiting volatile but correlated returns are penalized. Returns that are not correlated with market returns are considered to be unsystematic risk, as they can be diversified away through a broad portfolio. A stock with a beta of one is considered to be of average systematic risk, while a stock with a beta of greater than one is considered to be in a higher risk category. Stock betas lower than one indicate lower than average (systematic) risk. The period of analysis when calculating the beta is generally five years of monthly returns.

Estimating the market risk premium at 4 to 5 percent provides an idea of the impact that the beta has in the determination of the cost of equity. A beta of 0.5 results in a cost of equity approximately 2 to 2.25 percent lower than the average, while a beta of 1.5 results in the opposite (2 to 2.25 percent higher than average). The impact on the before-tax cost of equity would be amplified depending on the marginal corporate tax rate.

In order to complete the process of calculating the cost of capital, the cost of equity is weighted against the firm's or industry's cost of debt (as well as preferred shares), arriving at the weighted-average cost of capital. This approach recognizes that businesses are usually financed by more than just pure equity. Debt costs are generally observed through corporate bond yields.

It should be noted that there exists considerable debate surrounding the parameters used when determining the cost of equity with the CAPM. For example, the beta is often "degeared" in order to arrive at a pure asset beta, or the beta that would be calculated in the absence of any leverage.[3] In addition, the use of short vs. long-term bonds for the risk-free rate, the definition of the market portfolio and the length of the period analyzed for the beta calculation are all subject to debate. Furthermore, the CAPM itself is not immune to criticism, although empirical evidence suggests that the model is widely used among private sector firms[4], as well as in regulatory environments.[5] The purpose of this paper is not to debate the merits of the CAPM or to provide precise estimates of the cost of capital.

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[3] This is usually done with some variation on the Modigliani-Miller proposition. In its basic form it states,

$$R_E = R_{E(unlevered)} + (D/E)(R_{E(unlevered)} + R_D)$$

Or, in order to solve for the unlevered value of R_E,

$$R_{E(unlevered)} = (D/V)R_D + (E/V)R_E$$

[4] Gitman and Vandenberg, "Cost of Capital Techniques Used by Major US Firms: 1997 vs. 1980." 1998. See also Graham and Harvey, "The Theory and Practice of Corporate Finance: Evidence from the field." 2001.

[5] See Canadian Transportation Agency, "Calculating a Cost of Capital Rate," www.cta-otc.gc.ca

Instead, it aims to use the methodology developed for the purpose of calculating the beta in order to provide a rough indication of the perceived riskiness of investments in the transportation sector.

Scope of Coverage

This paper covers air carriers, rail carriers and trucking carriers that are traded on North American stock exchanges. The number of Canadian carriers that are listed is quite limited, while the number of US carriers is more robust. In general, we can have more confidence in sector or industry betas because they smooth out potential anomalies. However, they are less 'precise' as they provide a measure of volatility for the sector as a whole, rather than for individual firms.

Due to the limited number of Canadian carriers, their betas have been calculated and are presented individually. US carriers are presented as sector averages. Furthermore, some analysis of sub-sectors is also provided, such as truckload (TL) vs. less-than-truckload (LTL) among trucking carriers. This could provide some detail regarding the related but unique business risks faced by carriers in each group.

Transportation Sector Betas

This section will present the stock betas for six consecutive quarters for the Canadian carriers and sector averages in the US. Air carriers are presented first, followed by rail and trucking. Canadian betas were calculated relative to the TSX index, while US industry averages use the S&P 500 as the benchmark. The trailing five years of monthly returns were usually used in order to calculate the Canadian betas, although slightly shorter time series were occasionally used where data did not extend that far back.

Air Carrier Betas

There are three air carriers listed on the TSX, ACE Aviation (Air Canada), WestJet and Transat AT (Air Transat). Due to the restructuring of Air Canada in 2004, it is only recently that we have five years worth of monthly returns in order to calculate the beta. As a result, the Air Canada time series only extends back two quarters (in fact, the first of those two quarters relies on less than five years data). It should also be noted that ACE Aviation is a holding company that currently owns 75 percent of Air Canada (with the intention of winding down completely after spinning off several divisions). While it may be optimal to use the pure Air Canada price history, ACE Aviation price history was used instead due to the longer time series available.

Transat AT is also a holding company, the principal holding being Air Transat. The beta values are driven mostly, but not entirely by air passenger services as a result.

The following table presents the beta values for the three carriers for six consecutive quarters ending in November 2008. The final quarter may be of particular interest as it marks the beginning of the significant symptoms of the credit crisis and the crash of world markets.

Table 1 – Canadian Air Carrier Betas

Carrier	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
WestJet	0.77	0.70	0.97	0.84	0.37	0.56
ACE Aviation					1.41	1.66
Transat AT	0.63	0.34	0.31	0.28	0.29	0.79

WestJet's beta has actually decreased in the recent quarters and has remained lower than one over all six quarters. Air Transat's beta has also remained lower than one, although the beta increased significantly in the most recent quarter. The extent to which the beta fluctuates may be somewhat surprising considering that from one quarter to the next, 57 of the 60 months are common. However, the

Air Transat beta increased from 0.29 to 0.79 in the last quarter due to the fact that Transat's stock value has declined from over $20 to under $10 during that period, moving in the same direction (but greater percentage decline) as the benchmark. Furthermore, the three months of data that were displaced were months where Transat's stock actually moved in opposite directions of the market.

For the two periods of observed data, Air Canada's beta was well over one. The higher beta relative to WestJet is not surprising. Air Canada faces a greater number of uncertainties while WestJet has continued with consistent growth (although no doubt feeling the impact of the economic situation as well). Furthermore, Air Canada has had to deal with some specific issues that have been exacerbated during the economic downturn. For example, the defined benefit pension plan that Air Canada provides to its employees has left the company with a large pension deficit due to the decline in value of the pension portfolio. On the other hand, WestJet does not provide a defined benefit plan. Air Transat, while not considered a low-cost carrier like WestJet, also does not provide a defined benefit plan to most of its employees (only a small number of employees are provided with defined benefit pensions).

Stock betas for carriers traded on the US exchanges are more readily available from online sources. Therefore, no calculations were needed. Instead, betas were recorded from reuters.com in each quarter. The betas were weighted according to the market capitalization of each company for an industry average. In total, betas for 11 air carriers were available, four of which were categorized as low-cost (such as Southwest and JetBlue), with the rest considered to be legacy carriers. The following table presents the betas over the six quarters.

Table 2 – Air Carrier Industry Betas (US Exchanges)

Sector	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
Total	1.94	1.69	1.64	1.14	0.93	0.73
Legacy	2.64	2.75	2.54	1.91	1.84	1.36
Low cost	0.73	0.76	0.73	0.65	0.36	0.39

It is interesting to note that the beta has decreased over the period for both the total and the sub-categories. This may reflect in part the decline in fuel prices over the latter periods, which have helped offset some of the weakening demand during the difficult economic climate. In the case of the legacy carriers, it may just be a result of the beta declining from unusually high values recorded during 2007.

In terms of the dichotomy between legacy and low cost carriers, the results reflect the differences observed between the WestJet and Air Canada betas. Judging by the beta values, low cost carriers are considered to be inherently less risky than legacy carriers, and less risky than average. Their more flexible cost structure and no (or less) frills service may help them deal with periods of economic uncertainty and be more attractive to investors as a result.

Betas of air couriers traded on US exchanges were also recorded over the six quarters. This includes three couriers, UPS, FedEx and Air Transport Services Group (DHL). Due to the fact that the betas were weighted by market capitalization, the aggregated betas depend mostly upon UPS and FedEx. The aggregate air courier betas are contained in the following table.

Table 3 – Air Courier Industry Betas (US Exchanges)

Sector	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
Air Couriers	0.56	0.97	0.78	0.68	0.83	0.64

While the air courier betas have fluctuated over the period, the trend has been virtually flat. It is perhaps more surprising that the beta has remained below one for the entire period, considering the nature of the business and dependency on the business cycle.

However, it is possible that investors consider both UPS and FedEx to be businesses that are more stable than average and this contributes to the lower stock betas.

Rail Carrier Betas

Stock betas were calculated for both CN and CP Rail for the same six quarters analyzed above. In the case of both CN and CP, shares are listed on Canadian and US exchanges. Betas were calculated for the Canadian listings against the TSX as the market portfolio. However, the US listed betas were also recorded and used in the industry averages. It is interesting to note that the betas calculated for the latter were significantly higher than the former.

The stock betas using the Canadian listings are presented below.

Table 4 – Canadian Rail Carrier Betas

Carrier	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
CN Rail	0.91	0.97	0.80	0.84	0.66	0.47
CP Rail	0.80	0.68	0.62	0.70	0.71	0.68

Betas for both carriers were below average over the entire period. While certainly dependent on the economic cycle, the carriers have also been moderate in terms of expanding in anticipation of increased traffic and this may have helped them now that the traffic has not materialized (or at least traffic growth will be delayed to some extent). Being faced with less direct competition may also shield them to some extent from short-term volatility. However, it is interesting to note that the US betas for CN and CP have been higher than one. Possible reasons for this are provided below.

All rail carrier betas in the US have not been as low and in fact have been slightly higher than average for the most part. Table 5 presents the aggregate beta for each quarter, weighted by market capitalization.

Table 5 – Rail Carrier Betas (US Exchanges)

Sector	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
Rail Carriers	1.06	1.37	1.15	1.21	1.22	1.14

The industry beta has been above but close to one for most of the period. This may be a result of the fact that the industry is mature and the risks are known and well understood (but remain risks nonetheless). In fact, virtually all of the carriers in the group remained close to the industry average (only the KC Southern beta was significantly higher than the rest in the most recent quarter).

As mentioned, the CN and CP US betas are higher than the Canadian betas (generally close to the US aggregate average in table 5). This difference can be explained by two factors. The actual stock values are denominated in the home currency on each exchange and are equal in value when taking into account the exchange rate. The Canadian dollar has depreciated in value relative to the US dollar since mid-2008, meaning that CN and CP stocks traded on the TSX have increased nominally against their respective stocks listed on the NYSE. This would cause the stock value to move in the opposite direction of market portfolio (when it was declining) over much of that period.

The second factor is the difference in the market or benchmark portfolio itself. The TSX is heavily dependent upon a few sectors (such as resources and financials). While the rail carriers are dependent upon the fortunes of some of these resources they are perhaps not as dependent upon the well being of others (such as oil where increased oil prices negatively impact the bottom line of the carriers). The lower correlation between the two would lead to a lower beta whereas the broader US exchanges may be more reflective of general economic activity. In fact, a low diversification among the components of the TSX (relative to other exchanges) may be a strong argument against using it as a benchmark portfolio.

Trucking Carrier Betas

Stock betas were calculated for four trucking carriers, a small portion of the several hundred (generally much smaller) carriers operating in Canada. Many carriers have converted to income trusts (and have or will be converting back), resulting in a somewhat limited time-series of stock values as a result. Betas were calculated for each quarter although it should be noted that slightly fewer than 60 months worth of data were used in some cases. Stock betas for the four carriers are provided below.

Table 6 – Canadian Trucking Carrier Betas

Carrier	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
Contrans	0.63	0.66	0.80	0.72	0.69	0.93
Mullen	0.88	0.80	1.19	1.14	1.51	2.78
Transforce	0.67	0.76	0.79	0.44	0.43	0.90
Vitran	0.45	0.46	0.13	-0.01	-0.36	0.51

Trucking carriers have varied considerably over the period, mostly on an upward trend. Mullen, which announced the intention to revert to a corporate structure late last year, has seen its beta increase more than three-fold over the period. The acquisition of Essential Energy Service's oil field hauling business may have contributed to this. It may also be a coincidence to some extent that Mullen's shares have plummeted in 2008 while the rest of the market was also under downwards pressure.

Outside of Mullen, the stock betas are perhaps surprisingly low, considering the low margins and high competition in the industry. However, the low fixed cost structure and overall agility of the industry in terms of adapting to changes may help reduce investment risk.

The US exchanges are home to a much larger number of trucking carriers and betas have been weighted by market capitalization in order to derive an industry average. Furthermore, truckload and less-than-truckload carriers are distinguished from each

other in order to provide an indication of the varying levels of systematic risk, if any, between the two. Table 7 provides this detail.

Table 7 – Trucking Carrier Betas (US Exchanges)

Sector	Aug.07	Nov.07	Feb.08	May.08	Aug.08	Nov.08
Trucking	0.73	0.83	0.75	0.63	0.56	0.72
TL	0.89	1.22	0.83	0.63	0.53	0.65
LTL	0.53	0.69	0.66	0.64	0.60	0.83

Interestingly, the US trucking betas are also below average for the most part, with the betas trending flat over the entire period. This too could be attributed to the low fixed costs and high adaptability of the industry as demand certainly varies considerably with the economic cycle. In recent quarters TL betas have fallen below LTL betas, reversing the trend from previous quarters. It is difficult to read a great deal into these short-term results and the differences are not significant for the most part.

Managing Volatility

Transportation is a notoriously cyclical business and dependent upon the economic cycle. However, carriers and the industry as a whole have improved their ability to cope with fluctuations in demand for their services through improved demand forecasts, planning capacity expansion carefully and maintaining flexibility in capacity where possible. This may be one reason why transportation betas in general are not as high as one might expect for such a cyclical business.

On the other hand, carriers have been faced with perhaps unprecedented volatility on the cost side over the past two to three years in particular. Fuel prices increased rapidly until mid-2008 before dropping just as quickly since then. Exchange rate volatility has made forecasting profit margins more difficult as well. More recently, borrowing costs have increased as capital markets have dried up almost overnight.

The change in fuel costs alone is no small matter. Fuel costs have reached approximately one-quarter of air and trucking carrier total costs[6], for example. Yet the industries have been remarkably resilient in this environment. Fuel price hedging may be one factor that has allowed carriers to better match their revenues and costs in the short-term. For example, Air Canada hedged 20 percent of its fuel costs through derivative contracts on jet fuel and other crude oil based commodities[7] (heating oil remains popular for this purpose due to the liquidity of heating oil derivatives). However, WestJet, CN and CP Rail have largely halted their hedging activities after 2006 as oil prices approached and exceeded all-time highs, citing fuel surcharges as a more viable alternative.

Part of the rationale for this change in policy was the increasing risk of accumulating losses on these hedging contracts. Indeed, Air Canada has and will continue to recognize losses on these contracts due to the collapse in oil prices. However, the goal of hedging (on fuel prices to currency or otherwise) is to manage predictability of costs in order help determine profitable levels of output, rather than to speculate on future prices. Ceasing and resuming hedging activities as prices clime and fall is the equivalent of speculation, and it remains to be seen if this will adversely impact the business in the long run.

Fuel surcharges can be effective for the purpose of managing volatility as well. However, it is important to distinguish between true surcharges and those that are simply price increases. For example, trucking and rail carriers have implemented surcharges that essentially depend on the price of fuel at the time the service is delivered. This improves their ability to determine profitable levels of service and essentially passes the volatility in fuel prices along to their customers. On the other hand, air passenger fuel surcharges are simply price increases, loosely tied to the price of fuel at the time the ticket is purchased. However, since tickets can be purchased several months in advance and the surcharges only loosely vary with the price of fuel

[6] Economic Analysis, Transport Canada
[7] Air Canada Annual Report, 2007

and stage-length (domestic vs. international movements), the practice is not very useful for matching revenues with costs. Perhaps it is not feasible to charge passengers true fuel surcharges in the way freight customers are charged. Nevertheless, the fact remains that the passenger 'surcharge' is not an effective substitute for hedging.

Conclusion

According to the theory of systematic risk, firms engaged in business that varies in line with the general economic cycle will be faced with a higher cost of capital than others. The stock beta is a key input in the determination of the level of systematic risk according to the CAPM. Despite the fact that the fortunes of transportation depend heavily on commerce in general, the transportation stock betas examined here appear to be average or low (with the exception of legacy air carriers).

Furthermore, we have not seen a consistent and distinct increase in the beta values during the recent economic turmoil. It is possible that those carriers that have been successful in fuel hedging or implementing effective surcharges (rail, trucking) have been able to reduce systematic risk by passing it on to their customers. Fuel surcharges for air passenger carriers are not effective hedges as they act only as a price increase (rather than a charge based on fuel price at the time that the service is rendered). Furthermore, legacy air carriers continue to be saddled with higher fixed costs and remain less flexible in periods of fluctuating demand, increasing the magnitude of profits and losses. For example, pension assets experience rapid appreciation during periods of economic expansion while the inverse is true during economic contraction, creating even more systematic volatility than what would occur otherwise. In these circumstances, it is not unexpected that those carriers continue to exhibit high beta values and are considered to be riskier investments.

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