Testing Static Tradeoff against Pecking Order models of Capital Structure

(By Mark Suarez; 2005)

Introduction:

The theory of capital structure has been mainly dominated by the static tradeoff theory, which suggests that firms move towards an optimal debt ratio. On the other hand, many have suggested a pecking order model were firms fund their deficits by following strict hierarchical financial policy overtime. This theory is a direct implication of the asymmetric information problem discussed in Myers's "Capital structure puzzle" paper and in Myers and Majluf's paper in 1984. To support their arguments this paper (M Suarez) tries to test traditional target adjustment models against simple pecking order models by running time series regressions as well as by establishing statistical power. From these results they suggested that the simple pecking order model performed much better than the tradeoff model in explaining changes in debt ratios. Therefore I will concentrate most of my analysis on the time series regressions supporting the pecking model since they provided relatively little evidence to reject most of the cross sectional analysis in support of the tradeoff model. Firstly, I will examine the definition used when testing both models as well as empirical evidence for each. Secondly, I will examine in more detail the time series analysis done for both specifications. Finally, I will conclude with some remarks regarding the validity of the pecking order model and its empirical tests.

Primary Results:

Given the simple pecking order specification's assumptions and constraints they found that the model had a relatively higher explanatory power when compared to the static tradeoff specification. In addition, through the use of Monte Carlo simulations of debt financing histories they showed the pecking order as having statistical power while the target adjustment model did not (definition later on). As a result they concluded that the Pecking model is a more reliable model that the tradeoff model when tested against actual data.

The Pecking Order model Vs Static Tradeoff model:

Before moving on to the time series analysis it is worth examining the definitions used when testing both model. As briefly mentioned in the introduction the static tradeoff theory predicts an optimal level of debt as a result of tradeoffs between tax advantages from interest (deductibles from taxable income) and costs of financial distress. Therefore a value-maximizing firm will equate the benefits and costs at the margin and operate at the optimal capital structure or D/E ratio. This theory empirically suggests mean reverting behavior of actual debt ratios towards an optimum assuming that target debt ratios remain constant. It also predicts a cross sectional relationship between average debt ratios and asset risk, profitability, tax status and asset types. (Even though they have also found that many of these coefficient don't exhibit statistical power).

Nevertheless there is evidence that the three most important factors in the determination of a target debt ratio are the tax status of a firm, types of assets and operating income uncertainty (From P.Marsh; "Choice between equity and debt"). All of this implies that when firms make their financial decisions they are in fact moving towards an optimal debt ratio. The dependent variable in the target adjustment specification used to explain the variability of debt ratios was the deviation of actual debt ratios from the optimal debt ratio (see below). In addition, since the optimal debt ratio was unobservable the historical mean book debt ratio was used as its proxy.

1) **Dt = a + bt(Dt-Dt-1) + et**

The empirical evidence supporting the static tradeoff theory in the literature is vast. To start with there is evidence supporting the mean reversion of actual debt ratios towards an optimal debt ratio. This suggests that firms do in fact aim for a specific long run debt ratio target (supported by Taggard, Jallilvand, Harris, Opler and Titman). We also see significant cross sectional coefficients in explaining differences in debt ratios across industries. Thus suggesting significant variables as proxies for these target debt ratios. Finally, target adjustment models appear to work well in explaining actual changes in debt ratios when dividends are allowed to fluctuate. This could support the idea that increases in debt ratios are consistent with an increasing target as firms expands assuming dividends are allowed to gradually adjust over time (supported by Shyam and Sunder, 1988).

On the other hand, the pecking order model states that firms prefer internal equity (i.e. retained earnings) to external financing, but in the event of external financing debt is preferred to equity. This implies that debt ratios are the result of cumulative financing decisions over time as opposed to moving closer to a long run target. Hence financial deficits are the driving force behind debt issues. As I alluded to in the introduction, the pecking order theory originated from the added costs that asymmetric information imposes on investment and financing decisions. This is due to primarily two factors, one direct and one indirect. First, external equity financing can be expensive because of the transaction costs involved in dealing with investment bankers. This is due to large fees and the under-pricing usually seen in the early phases of IPOs that managers must deal with (mostly under "bought deals"). Secondly, since corporate insiders know more about the firm than outside investors, equity mis-pricing is more likely to occur. In other words, it's more likely that corporate signals, like changes in dividend policy or equity issues and repurchases, could be strongly misinterpreted by the markets. This makes equity financing more costly and thus less preferred. For example, if firms try to repurchase equity on the secondary markets, as soon as the purchasing announcement is made there would be an increase (presumably an over reaction) in prices that may not be legitimized by fundamentals. This will definitely increase the costs involved in equity or leverage reducing transactions. All of this naturally leads to the idea that as long as firms can issue "safe debt" (default free) they can escape most of the costs (as well as liquidity costs) from equity financing. So what we gather from Myers and Majluf's (1984) definition in that we have two cases. In the first case, if the costs of financial distress are ignored, then the firm will issue securities that will have the lowest stock price effects

(hence effects on shareholders' wealth). This implies that as long firms can issue investment grade debt, on average, it will have zero stock price effects. So that in this case the manager will not issue equity. In the second case, if the costs of financial distress are high, the firms will only issue equity as long as managers are relatively less optimistic than outsiders (securities are over-priced). If in fact managers are more optimistic about future prospects than investors then no equity will be issued. In addition, it's further assumed that when a firm has a surplus and there are taxes or other costs of holding excess cash, there will be an incentive by managers to pay down the debt. Empirically this means that firms can either be net lenders and net borrowers. (Although this prediction would change if there were substantial costs associated with very low levels of debt).

2) $\mathbf{dDt = a + bDEFt + et}$ where $DEFt = (DIVt + Xt + dWt + Rt) - Ct$

Of all the empirical evidence supporting the pecking order theory there are at least three which are most cited throughout the literature. First, it has been shown that there is a negative valuation effect from equity issues. This implies that if firms are in fact moving towards a long run target we should see value enhancing effects when issuing equity (as those predicted by the static tradeoff model) rather than value decreasing effects. Second, there is a negative relationship between debt ratios and past profitability. This supports the idea that as firms run out of internal funds they will first resort to debt as opposed to equity. It also decreases the possibility that firms do issue more debt since a bigger taxable income calls for greater tax reductions (thus the tradeoff model predict a positive relationship). Third, as described in this paper the pecking order model can be rejected under a simulated path for debt ratios using the simple target adjustment model while the target adjustment model cannot be rejected under a simulated path of debt ratios using the pecking order specification. This suggests that not rejecting the static tradeoff model under the actual path of debt ratios have little statistical power. I will discuss the idea of statistical power when we get to time series analysis.

DATA:

Before moving on to the results of the time series analysis we have to keep in mind the kind of firms used when testing the significance of these models. Most of the firms included in the sample were large public firms with conservative debt ratios. This implies that most of these firms issued investment grade debt and had relatively stable target debt ratios (assuming a tradeoff model). This fact could work against the significance (or statistical power) of the target adjustment model since these target debt ratios would remain unchanged.

Time Series Analysis:

In the first part of the time series analysis they simply tested the pecking order model and the simple target adjustment model against the actual paths of debt ratios (see table 2). What they found was that both models provided statistically significant coefficients but that the simple pecking order model had better explanatory power.

In addition to finding relatively higher R squares and coefficients they also looked at whether the good fir of the pecking order model had more to do with short-term adjustments than planned financing. In other words, they were trying to see if most of the changes in debt ratios actually occurred due to the inability of management to issue equity on a short-term notice than to a strict preference of debt over equity over an extended period. Even though the issuance of debt over equity over the short term would still be consistent with the pecking model they wanted to make the story more convincing by observing this type of firm preference over the long run. In order to test this story they regressed anticipated deficits (or planned deficits) over changes in debt ratios to see if most of the variability could be explained. In order to proxy for planned deficits they used lagged deficits and lagged funds from operations as well as changes in net working capital. They did not include changes in capital expenditures and dividends since they assumed that firms (thus not adding to unanticipated deficits) could easily forecast these variables. The results from these regressions (see table 3) suggested that the pecking order coefficients were still different from zero when both instruments were used independently as well as when they were used together. Also the constants were not different from zero suggesting that most of the variability in debt ratios (debt issues) was the result of planned deficits and thus a strict preference of debt over equity.

Statistical power:

Next they turn their attention towards testing the statistical power of both models. Thus they generated hypothetical time series of debt issues and retirements (one series for each of the 157 sample companies) using both the simple target adjustment model (with a constant target) and the pecking order model. They did this so as to recreate two worlds, one of which would be strictly guided by the pecking order theory and the other by the static tradeoff theory. So in the end they had two simulated debt financing histories based on actual investments and operating data *(see specification 1 and 2 above*). So for example, if the pecking order model is to have any statistical power its coefficients should be rejected once it is tested against a simulated path of debt ratios generated by the target model (under a world guided by the tradeoff theory) with a constant target. The same procedure applies to the target adjustment model.

Before getting to the results it is worth mentioning the assumptions used to generate a hypothetical path of debt ratios using the target adjustment model. First, an actual historical mean book debt ratio was used as a proxy for each of the firms' target. This meant having a constant long run target debt ratio. Second, they used a constant adjustment coefficient of .41, which they got from table 2 (from the first part of the analysis). Third, allowing the target debt ratios to vary year by year and firm by firm generated a third simulated debt ratio path. These target debt ratios were determined by firm's characteristics such as the types of assets, R&D, tax status and operating earnings. In addition, specific coefficients were assumed to be constant for many of these variables. Finally, even when the targets were allowed to fluctuate, most of the sample firms' targets did not change very much over time.

3) **Dt = a b1(plant) + b2(R&D) + b3(effective taxes) + b4(earnings) + et**

The results for the most part were somewhat surprising (*refer to table 4; first column*). First, the pecking order model had no explanatory power for the simulated data based on the target adjustment model. This indicated that the pecking order model could be rejected when in fact it was false. Thus the simple pecking order model had statistical power. Second, the target adjustment specification fitted the simulated pecking order series just as well as in the actual data. Therefore they inferred that the usual tests done for the target model lacked power. (*Note: The target debt ratios seemed to change very little over time. Nevertheless the same result held when 3 and 5 year moving average target debt ratios were used).* Finally, the mean reversion of debt ratios generated by the pecking order specification (due to string of years with financial deficits, followed by strings of surpluses) could explain the good fit exhibited by the target adjustment coefficients. This implies that the target adjustment model could in principle lead to a false positive (not rejecting) when tested under actual data.

So to recap, the pecking model seems to be a good descriptor of actual financing behavior. Second, the pecking order model performs well under actual data with strong and significant coefficients. Third, the strong performance of the pecking model is the result of anticipated deficits as opposed to firms financing unanticipated cash needs with debt in the short term. Finally, the Monte Carlo simulation shows that the simple target adjustment model is not rejected even when it is false. Although the pecking order model, when false, can easily be rejected.

Arguments supporting the Pecking Order model:

1) Negative valuation effect from the issuing and repurchasing of equity
2) Negative relationship between debt ratios and profitability
3) Planned deficits seem to explain most of the variability in debt ratio changes
4) The target adjustment model could not be rejected even when it was false.
5) Some cross sectional coefficients were found to have no statistical power in explaining differences in debt ratios across industries
6) The pecking order model seemed to have more explanatory power (higher R square) when regressed against actual data

Counter-arguments or Criticisms:

Regarding the first argument, the negative valuation effect from equity or leveraging reducing transactions could be explained by the agency cost theory (Jensen's free cash flow hypothesis). This theory states that since managers have an interest to maximize their own utility ahead of those of owners, by reducing leverage (hence more cash flows because of lower interest payments) they will engage is discretionary spending or **rent seeking behavior**. This will indeed expropriate the firm's resources away from owners and towards managers and thus decrease shareholders' value. Therefore these negative valuation effects may not necessarily be interpreted as firms moving away from their long run target.

Secondly, the negative relationship between debt ratios and profitability can also be explained if high past profitability is perceived to be a proxy for higher growth opportunities. These higher growth opportunities could represent intangible assets that would increase the costs of financial distress. Hence higher profitability means higher expected bankruptcy costs giving rise to lower targets (as predicted by the tradeoff models).

Thirdly, the inclusion of capital expenditures in deficit calculations could actually increase the proportion of unanticipated deficits over total deficits (i.e. increase the significance of the constants). This means that a greater portion of the variability of actual debt ratios may actually be coming from unanticipated deficits. This can be interpreted as firms issuing debt because of short- term equity liquidity constraints. (This would lower the significance of the pecking order coefficients). This would especially be true for firms facing greater uncertainty in their capital budgeting decisions.

Fourthly, the target adjustment model could not be rejected under a world financed strictly by a pecking order theory. However this could be due to a number of reasons. One reason could be the fact that all of the firms in the sample represent large public corporations that belong at the maturity stage of the industry life cycle. This is why it would be difficult to proxy for these moving target debt ratios. This difficulty arises because most of these firms undergo relatively small changes in their capital expenditures, operating income, assets turnovers, and dividend policies (see cross section model number 3). Hence attempts to proxy for these moving targets would be more sensitive to changes in these variables over the sample period. In other words small adjustments to the target could mean accepting a false positive when testing it against the pecking order simulation while any large adjustments to the target (3 to 5 moving average target debt ratios) could mean rejecting it against actual changes in debt ratios. Therefore I propose a sample that includes firms going through a significant portion of their life cycle in order to better proxy for these moving optimal debt ratios. If target adjustment coefficients show to have statistical power as well as significant coefficients over actual debt ratio paths then debt issues could be perfectly consistent with increasing target debt ratios as firms expand. Another reason for the acceptance of a false positive is that when the target adjustment model was tested against actual data and simulated data (PO) it was assumed that the adjustment coefficient would remain constant. Nevertheless this assumption is far from reality since most firms are constantly changing. Therefore allowing for firm-varying coefficients could give us a much different result (supported by Jalilvand and Harris; 1984).

Fifthly, even though some coefficients may in fact exhibit no statistical power, others still show substantial significance. In other words, the pecking order model would still need to explain a high portion of the differences in capital structure across industries. This evidence of persistent inter industry differences in leverage is consistent with the idea of an optimal debt ratio. The three most significant determinants of optimal debt ratios are taxes, types of assets and uncertainty in operating income. For example, even though pharmaceutical firms in general have high earnings and low debt ratios, which would be consistent with the pecking order model, could also be consistent within a static tradeoff

framework. This is because these types of firms also have high operating income uncertainty as well as a high proportion of intangible assets, thus increasing expected bankruptcy costs (i.e. thus reducing their leverage ratios).

Finally, the pecking order's high explanatory power could be the result of sample bias towards large and mature firms. This implies that a sample of smaller growth firms may not provide the good fit require to establish statistical power to the pecking order specification. It's been observed that even small growth firms that have the ability to issue default free debt or venture capital (close ties with local banks) are characterized by very low levels of debt (even zero) and high levels of equity financing. It would be interesting to carry out similar procedures with these models using a different firm sample (i.e. composed of small venture capital firms) to then see if the pecking order model stands the test.