A Survey of Research of Target Debit Ratio

Yuang Zhou[1(✉)] and Sihan Qin[2]

[1] Faculty of Social Science and Public Policy, King's College London, London WC2R 2LS, UK
15001802474@163.com

[2] Columbia International School, Hamilton L8S 4P3, Canada

Abstract. When firms increase the amount of debt in a situation with corporate tax, the amount of the tax shield and the cost of bankruptcy increase. The tradeoff theory of capital structure states that firms choose their target debt ratio to maximize the value of firms. The problem is that the target can not be directly observed. Many scholars have hotly debated this. Some papers with empirical data test the tradeoff theory and support the target. However, some other articles show that the test of tradeoff theory has no statistical power and can not reject alternative hypotheses. In addition, some scholars test the evidence that supports the tradeoff theory and find out that the evidence has no statistical power. There are many studies on the target debt ratio, and this paper will look at some of the most important ones.

Keywords: Tradeoff theory · target-debt ratio · statistical power · partial adjustment · adjustment cost

1 Introduction

Modigliani–Miller claims that when the market is perfect, the capital structure of the firm does not change its value [1]. However, in the real world, interest payments by corporations to debt holders can be deducted from corporate taxes. On the other hand, increasing debt also causes higher bankruptcy costs. Leland developed the tradeoff theory of capital structure [2]. He states that there is a target debt ratio in which the marginal effect of the tax shield is equal to the marginal bankruptcy cost. This target debt ratio will maximize the firm's value.

This theory is so influential that many scholars write their papers based on it. However, it is not only academics who are concerned about the target debt ratio; in real life, the management of companies is also concerned about it. They aim to maximize the company's value, so how to achieve the target debt ratio is a fundamental problem for them to consider. Intrigued by such an academic and life-related issue, the decision was made to write a research survey on target debt rates.

The criteria for including a paper in the survey are discussed below in three steps. First, the article's topic must be the target debt ratio. Second, the picked paper contains

Y. Zhou and S. Qin—Contributed equally to this work and should be considered co-first authors.

S. Tehseen et al. (Eds.): ICEDBC 2023, AEBMR 258, pp. 598–606, 2024.
https://doi.org/10.2991/978-94-6463-246-0_72

empirical data and hypothesis testing. Third, the article must raise essential research arguments or unique ideas about the target debt ratio.

The structure of the paper is presented below. Starting by introducing the Modigliani–Miller proposition, the definition of tradeoff theory, and the target debt ratio. Then, some essential research papers on the target debt ratio will be presented. First, there is an explanation of a famous article on the empirical test of tradeoff theory written by Shyam-sunder and Myers [3]. This paper tests the tradeoff theory against the pecking order theory. The core result is that the statistical power of some hypothesis tests on tradeoff theory is nearly zero. The second paper presented the tests of evidence supporting the tradeoff model by Xin Chang and Sudipto Dasgupta [4]. They find out that some existing tests of tradeoff theory have no power to reject the alternative hypotheses [4]. Third, a paper demonstrates other research directions for the target debt ratio [5]. It finds the situation where most adjustments of capital structure happen. Byoun excludes the possibility of pecking order financing behavior in the paper.

After reading these papers, two questions about the target debt ratio were raised. First, do firms have a unique target debt ratio? The characteristics of a company vary over time, such as profitability and share price. Similarly, different companies have very different characteristics. Will these characteristics affect the target? Second, why do firms in actual life situations fully adjust to the target debt ratio only infrequently? As the tradeoff theory states, the target debt ratio would maximize the firm value. So, the manager should try his best to achieve the target. However, in real life, only a few firms fully adjust to the target debt ratio.

We use the paper by Armen Hovakimian, Tim Opler, and Sheridan Titman to answer these questions [6]. In this paper, the author suggests that firms may face some impediments that keep firms away from the target debt ratio. He also mentions that the target ratio changes over time as a firm's characteristic changes, and deviations away from the target debt ratio affect repurchase more than issuance decisions. To answer this question more thoroughly, some other papers written by Mark J. Flannery, Kasturi P. Rangan (2006), Armen Hovakimian, and Guangzhong Li will be presented. Mark and Kasturi use a more general partial adjustment model to prove the target [7]. Hovakimian find no evidence for complete adjustment and shows that the firm only adjusts to the target when the adjustment benefit is more significant than the cost [8]. De Jong and Verwijmeren examine the difference of having a target ratio or not [9]. Huang and Ritter not only tests the trade-off theory but also try to find the speed of adjustment of the model [10]. Hovakimian and Armen study the role of target leverage in security issues and repurchases [11].

2 Trade Off Theory and Target Debt Ratio

According to Miller and Modigliani's hypothesis, there are no taxes, competitive financial markets, or transaction costs, and all agents have access to the same information, no costs associated with bankruptcy, and no agency conflicts in a perfect world. The first time a no-arbitrage condition was used in economics was in MM's evidence. Modigliani and Miller each have two spots. Proposition 1 claims that capital structure is irrelevant because financial markets are ideal. Proposition 2 contends that because cash flows are

unaffected by capital structure, corporations' capital cost is also unaffected. According to the trade-off principle, businesses should trade-off the tax shield's value against the rising predicted bankruptcy costs until the two impacts are marginally equal. Additionally, the trade-off theory has some issues: First, some very successful businesses have little to no debt, and second, debt existed before corporate taxes. Leland is a crucial study for tradeoff theory. In this study, the author develops a dynamic capital structure model in which a default impacts how debt tax shields will be used in the future. The model is solved using continuous time methods, and it is attempted to calibrate the models to actual data. The Myers and Majulf model were referenced in pecking order theory; this model's equations are easier to understand than those of the Leland model. All agents in Myers and Majulf's model are risk-neutral wealth maximizers, all agents are patient, and it has a one-period structure with two dates.

3 Key Paper Discussion

3.1 Testing Static Tradeoff Against Pecking Order Models of Capital Structure

It is a famous paper testing the tradeoff theory against the pecking order theory. The tradeoff model shows there is a target debt ratio that firms try to achieve. Unexpected events can cause the current debt ratio to deviate [3]. If the target is constant, it is reasonable to see the mean-reverting behavior. The specification of tradeoff used in the paper is:

$$\Delta D_{it} = a + b_{TA}\left(D_{it}^{*} - D_{it-1}\right) + e_{it} \tag{1}$$

where D_{it}* means the target debt ratio, b_{TA} is a constant target adjustment coefficient. The hypothesis tested is $b_{TA} > 1$, showing a target adjustment behavior. Also, $b_{TA} < 1$ indicates some adjustment costs. This simple specification shows ΔD_{it} can be explained by the flucuatitions of the debt level from the target.

The samples are chosen from Industrial Compustat files. The author restricted the sample from all firms in Industrial Compustat files to 157 firms. The period of the data is from 1971 to 1989.

First, the author used ordinary least square tests. The dependent variable is ΔD_{it}. The author found the constant near to zero and $b_{TA} = 0.41$. The R^2 for the regression is 0.25.

Then, the author ran three different specifications that use ΔD_{it} as the dependent variable. The regression results are $b_{TA1} = 0.26$, $b_{TA2} = 0.32$, $b_{TA3} = 0.32$.

The author concludes the target adjustment model has some power to explain ΔD_{it}, and the coefficients of target adjustment are all statistically significant. Yet, the alternative theory has much stronger explanatory power than the simple tradeoff model.

After that, the author examined the power of these tests. He found out that the target adjustment model can provide some beautiful results when it is false. The target adjustment model lacks the power to reject the wrong hypothesis. To evaluate, the author suggests the tradeoff models he used in the test are too simple [3]. He could use more complex and realistic tradeoff models. Hence, the tradeoff models may perform better than now.

3.2 Target Behavior and Financing: How Conclusive is the Evidence?

In this paper, the author mainly examines the power of some evidence that supports the tradeoff theory and target debt ratio. They generate simulated data where financing behavior is not based on the target or current debt ratio [4]. They found that this simulated sample can generate much evidence that supports the target debt ratio. Hence, they indicate that most of the evidence of the target debt ratio suffers from a lack of statistical power.

First, they describe the mean-reverting behavior based on Shyam-sunder and Myers' work, which indicates mean reverting should occur when the firms adjust their capital structure using the tradeoff theory and having a constant target [3]. Then, they suggest it is inappropriate to test on specifications based on the target adjustment coefficient by explaining the idea of mechanical mean reversion. Mean reversion can happen for mechanical reasons without a target debt ratio [4]. Hence using mean reversion behavior to infer the existence of target debt behavior is inaccurate.

There are two types of sample data used in the paper. The first type is actual data from Industrial Compustat files from 1971 to 2004. The second type is simulation data generated under some alternative hypothesis. The test results show that most existing tests of target debt ratio suffer from a lack of statistical power. Mean reversion tests can not differentiate target debt behavior from mechanical mean reversion situations [4]. The author concludes that checking the financing behavior is essential in identifying the target debt behavior because tests on the issuance activities of firms do contain the power to reject alternative hypotheses.

3.3 How and When Do Firms Adjust Their Capital Structure Towards Targets?

This essay discusses whether a corporation should modify its capital structure to its goals. The author suggests a finance demand-induced adjustment paradigm to analyze the process through which businesses change their capital structures. According to the author, corporations with financial rubles (deficit) and above-target debt (below-target) cause unfairness. These findings imply that enterprises migrate towards the goal per capita structure when they experience budgetary deficits or surpluses, contrary to what classic hierarchy theory predicts [5]. The author covers the target adjustment model, technique, data, and summary statistics. A typical specification can be written as follows:

$$\Delta D_{it} = [\frac{D}{A}]^{*}_{it} A_{it} - D_{it-1} \ldots \tag{2}$$

where A_{it} is the entire assets of firm i at time t, D_{it} is the total debt of firm i at time t, and represents the target debt to asset ratio for firm i at time t. A version of the target adjustment model with normally adjustment speed of 100% is represented by this equation [5].

The authors used the method of multiplying both sides of equation i by A_{it}. They allow for alternation between rising and falling leverage due to different rates of adjustment to complete the target adjustment model as follow:

$$\frac{\Delta D_{it}}{A_{it}} = a_1 + a_2 TDE_{it} D_{it}^{above} + a_3 TDE_{it} D_{it}^{above} + \epsilon_{it} \ldots \tag{3}$$

The authors produced a sample of observations using Compustat data from 1972 to 2003. This function is a dummy variable with t = 1 if leverage is above the target and vice versa. D_{below} is also a dummy variable with firm i equal to 1 at time t if leverage is below the target and equal to 0 vice versa [5].

The author then created a second table: Expected indications of adjustment, their magnitudes, and their propensities to use debt to cover surpluses or deficits in the budget. The following regressions' estimated coefficients are given their predicted signs in the accompanying table:

$$\frac{\Delta D_{it}}{A_{it}} = \left(\beta_1 D_{it}^{surplus} + \beta_2 D_{it}^{deflict}\right) + \left(\beta_3 D_{it}^{surplus} + \beta_4 D_{it}^{deflict}\right) TDE_{it} D_{it}^{above} + \left(\beta_5 D_{it}^{surplus} + \beta_6 D_{it}^{deflict}\right) TDE_{it} D_{it}^{below} + \varepsilon_{it}, \quad (4)$$

$$\frac{\Delta D_{it}}{A_{it}} = \left(\gamma_1 D_{it}^{above} + \gamma_2 D_{it}^{below}\right) + \left(\gamma_3 D_{it}^{above} + \gamma_4 D_{it}^{below}\right) FDA_{it} D_{it}^{surplus} + \left(\gamma_5 D_{it}^{above} + \gamma_6 D_{it}^{below}\right) FDA_{it} D_{it}^{deficit} + \varepsilon_{it}, \quad (5)$$

where TDE_{it} is the financial surplus or deficit, and the value of TDE can be calculated by dividing cash dividends by the value of firm I's assets at time t; TDE_{it} is the deviation of firm I's debt ratio from the target ratio at time t. D_{it}^{above} is a dummy variable for firm i at time t. D_{it}^{below} is a dummy variable for firm i at time t equal to 1 when the leverage ratio is below the target; otherwise, it is equal to 0. Ditsurplus is a dummy variable for firm i at time t equal to 1 in the presence of a financial surplus and equal to 0 in the absence of surplus is equal to 0 [5].

Table 1. Target Debt [Owner-draw]

	Above-Target Debt ($D^{above} = 1$)	Below-Target Debt($D^{below} = 1$)
Financial Surplus ($D^{surplus} = 1$)	Adjustment toward target requires reducing debt. With a financial surplus, the adjustment is expected to be easier: $\beta^3 > 0$ and large.	Adjustment toward target requires raising debt. With a financial surplus, the adjustment is expect expected to be slower: $\beta^5 < \beta^6$
	Financial surplus is used to reduce above-target debt: $\gamma^3 > 0$ and large.	Financial surplus may be used to reduce both debt and equity: $\gamma^4 > \gamma^3$.
Financial Deficit ($D^{deficit} = 1$)	Adjustment toward target requires reducing debt. With financial deficit, it is harder to a reduce debt: $\beta^4 < \beta^3$	Adjustment toward target requires raising debt. With a financial deficit, the adjustment is expected to be easier: $\beta^6 > 0$ and large.
	With above-target debt, it is harder to issue debt to meet a financial deficit: $\gamma^5 > \gamma^6$.	With below-target debt, it is easier to issue debt to meet a financial deficit: $\gamma^6 > 0$ and large.

The Table 1 shows that in other cases, for companies with debt below target, the adjustment is likely to be delayed when the company runs a financial surplus. Even though the authors measure the target in various ways, the important finding is based on a regression in which firm and industry parameters regarding earnings and operating costs for different leverage ratios are regressed on the observed debt ratios.

$$[\frac{D}{A}]_{it}^{*} = \lambda X_{it} + \varepsilon_{it}, \tag{6}$$

Based on the details provided in this equation, the author takes measurements of the target. 118,731 firm-year observations from the Annual Industrial Compustat files from 1971 to 2003 make up the sample. 100,339 firm-year observations for equations with pertinent Compustat data from 1972 to 2003 comprise another sample comprising a more extensive set of equations [5]. The author then assesses the capital structure modification in light of the modifications to external capital that are required as a result of the financial deficit or surplus. According to the results, modifications happen most frequently regardless of whether a business has debt levels above aim with a financial surplus or below target with a financial deficit. Overall, but not in the way that the conventional preaching order theory predicts, adverse selection costs associated with information asymmetry have an impact on how a firm modifies its capital structure. In conclude to determine when and how do firm adjust their capital structure, the author builds up some equations and finds examples to support the equations. From this essay shows how to target adjustment.

3.4 The Debt-Equity Choice

The author tests whether firms converge to the target debt ratio when repurchasing or raising new capital [6]. Also, the author indicates that the firm's characteristics change over time, causing its target debt ratio changes. The sample data are chosen from Standard and Poor's Compustat annual files. To test whether firms are moving toward the target debt ratio, the author first uses cross-sectional data of variables to estimate the target. Then, they compare the estimated target debt ratio with the firm's actual target debt ratio. The difference between two ratios will be included in the second step of the tests. Second, they include other variables that show the difference between the two debt ratios in the regression. The test results suggest that some pecking order influences short-run financing decisions, but firms will likely follow the target debt ratio in the long run. More profitable firms seems to have a lower target. Also, they are more likely to proceed repurchase decision rather than retire debt [6]. Firms experiencing higher stock prices tend to issue more equity, changing the target debt ratio. To conclude, the author claims most tests of the static tradeoff model lack power. The stock price is an essential determinant of a firm's financing choices. The author is interested in why the stock price significantly influences a firm's financing choices.

3.5 Partial Adjustment Toward Target Capital Structures (Mark J. Flannery[a,*], Kasturi P. Rangan[b])

In this paper, the irrelevance hypothesis proposed by Modigliani and Miller in 1958 is used as an example. The expectation is that there will be at least a short-term mechanical

impact on whether market timing has a long-term or short-term effect [7]. In this study, the authors utilize an empirical model that considers the potential for dynamically changing capital structures of firms. In addition, in order to test the regression model specification of the trade-off leverage so it is necessary to allow the target debt ratio of each firm to vary over time. The firm's market debt ratio is the authors' main leverage measure.

$$MDR_{i,t} = \frac{D_{i,t}}{D_{i,t} + S_{i,t}P_{i,t}} \tag{7}$$

where $D_{i,t}$ denotes at time t, the firm i's interest-bearing debt's book value. Si,t equals the number of common shares outstanding at time t, and Pi,t denotes the price per share at time t [7].

In addition, to model the possibility of target leverage for different firms or different periods the authors specify the form of the target capital ratio.

$$MDR^*_{i,t+1} = \beta X_{i,t} \tag{8}$$

where B is a vector of coefficients, $X_{i,t}$ is a vector of firm attributes relating to the costs and advantages of operating with different leverage ratios, and $MDR^*_{i,t+1}$ is the predicted debt ratio of firm i at t + 1. The effect of periodic changes on the parameters determined by our smoothing adjustment specification is next examined by simulating 20 panel data sets with 100,000 data points each [7]. All Industrial Compustat companies with complete data for two consecutive years between 1965 and 2001 are included in the sample. The authors claim that the speed of adjustment represents the typical firm's average speed.

According to the author, the preaching order paradigm has a lengthy history and tremendous intuitive appeal. According to the preaching order hypothesis, the financial shortfall should negate the impact of other factors. By contrasting the tradeoff, market timing, and pecking order models' capacities to account for variation, the table evaluates the economic significance of each model [7].

In conclusion, the author discovered convincing evidence that nonfinancial enterprises over the period of 1966 to 2001 established and pursued target capital ratios. Demonstrates how the desired debt ratio is dependent on industry-accepted corporate traits. According to this metric, under- or over-leveraged businesses change their debt ratios to close the observed discrepancy. Both market-values and book-valued leverage indicators show targeting behavior and the author shows how to find the market debt ratio and target debt ratio.

3.6 Do Firms Have Unique Target Debt Ratios to Which They Adjust?

This essay discusses how quickly businesses can change to reach their desired debt ratio. The author also looks at the rates of capital structure adjustment to target that were seen at a period when those gains were anticipated to outweigh those costs. In their analysis, authors include both book and market value metrics of leverage.

$$DR_{i,T+1} - DR_{i,T} = \alpha + \lambda\left(DR^*_{i,T+1} - DR_{i,T}\right) + \varepsilon_{iT+1} \tag{9}$$

$$DR^*_{i,T+1} = \widehat{\beta} X_{iT} \tag{10}$$

where DR^* is the predicted value obtained from regression. λ measures the average speed of adjustment to the target. The theoretical justification for the empirical examination of company capital structure decisions is then discussed and utilized the Fisher, Heinkel, Zechner, Goldstein, Ju, and Leland, and Strebulaev tradeoff models [8]. The years when the advantages of adjustment are expected to outweigh its costs are determined by the speed of adjustment by current maturity long-term debt, according to the authors. In this regard, maturing long-term debt serves as an exogenous variable that enables us to pinpoint situations in which the adjustment costs have been fully absorbed, enabling the firm to change to the target for a relatively low incremental cost.

The strength of their finding is next tested against a number of alternative techniques for calculating the rate of adjustment [8]. They start by pointing out that coefficients offer different, more significant estimates of the adjustment rate. Second, they produce more conventional estimates of adjustment speed.

Although the estimated adjustment speeds are noticeably higher, the authors find that firms do not fully adjust even in these situations. In addition, a sizable portion of significant financing transactions is connected to adjustments beyond or away from the target. Their findings suggest that firms behave differently than what is predicted by the conventional dynamic tradeoff theories. Overall, firms have unique debt ratio due to the differences of the situation of every firm and different target and scale of the firm.

4 Conclusion

From the results of many papers, the tradeoff theory appears controversial. It lacks power in many scholars' tests and cannot reject alternative hypotheses. In some papers that compare the pecking order theory against the tradeoff theory, the pecking order theory shows more substantial explanatory power than the tradeoff theory [3]. Most evidence supporting the theory is inconclusive [4]. Although the tradeoff theory is not very convincing, Shyam-sunder and Myer suggest that in future research, more complicated models and real-life settings may help to increase the theory's explanatory power. Their claim partly becomes true as the more complex partial adjustment model helps support a target debt ratio [7]. The tradeoff theory continues to be influential in the financial sector. It is the most fundamental theory for determining the capital structure. Many ideas in finance developed based on the target debt ratio, for example, the weighted average cost of capital. It is a fundamental model that every finance student and researcher cannot bypass. Future research could use more sophisticated models and more realistic settings to refine the tradeoff theory.

Acknowledgement. Yuang Zhou and Sihan Qin contributed equally to this work and should be considered co-first authors.

References

1. Franco Modigliani and Merton H. Miller. (1958) The Cost of Capital, Corporation Finance and the Theory of Investment. JSTOR, Vol. 48, No. 3: pp. 261–297
2. LELAND, H.E. (1994) 'Corporate debt value, bond covenants, and Optimal Capital Structure', The Journal of Finance, 49(4), pp. 1213–1252.
3. Shyam-Sunder, L. and Myers, S. (1999) 'Testing static trade-off against pecking order models of capital structure', Journal of Financial Economics, 51(2), pp. 219–244
4. CHANG, X. I. N., & DASGUPTA, S. U. D. I. P. T. O. (2009). Target behavior and financing: How conclusive is the evidence? The Journal of Finance, 64(4), 1767–1796.
5. BYOUN, S. (2008) 'How and when do firms adjust their capital structures toward targets?', The Journal of Finance, 63(6), pp. 3069–3096
6. Hovakimian, A., Opler, T., & Titman, S. (2001). The debt-equity choice. The Journal of Fi-nancial and Quantitative Analysis, 36(1), 1.
7. Flannery, M.J. and Rangan, K.P. (2006) 'Partial adjustment toward Target Capital Structures', Journal of Financial Economics, 79(3), pp. 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004.
8. Hovakimian, A., & Li, G. (2009). DO firms have unique target debt ratios to which they ad-just? SSRN Electronic Journal, 1–38.
9. De Jong, A., & Verwijmeren, P. (2010). To have a target debt ratio or not: What difference does it make? Applied Financial Economics, 20(3), 219–226.
10. Huang, R., Ritter, J.R., 2009. Testing theories of capital structure and estimating the speed of adjustment. J. Financ. Quant. Anal. 44, 237–271.
11. Hovakimian, Armen, 2004, The role of target leverage in security issues and repurchases, Journal of Business 77, 1041–1071.