Research-Thesis, COLLÉGIALITÉ

Auteur : Nieminen, Eerik
Promoteur(s) : Gautier, Axel
Faculté : HEC-Ecole de gestion de l'Université de Liège
Diplôme : Master en sciences économiques, orientation générale, à finalité spécialisée en macroeconomics and finance
Année académique : 2019-2020
URI/URL : http://hdl.handle.net/2268.2/10268

HEC LIÈGE
Management School - Liège Université

The role of legal domicile choice in capital structure decisions

Evidence from multinational corporations in the US and the UK

Student

Name:
Eerik Nieminen

Diploma:
Master en Sciences économiques, orientation générale, à finalité “Economics and Finance”

Academic year:
2019-2020

Jury

Supervisor:
Axel Gautier

Readers:
Joseph Tharakan
Alexandre Scivoletto

Acknowledgements

Sincere thanks to my academic supervisor Prof. Axel Gautier, the jury readers Prof. Joseph Tharakan and Mr. Alexandre Scivoletto as well as my parents.

Thank you for your advice, support and patience. Thank you also for the academic freedom you have given me.

Abstract

This thesis considers international differences in corporate capital structure decisions. As far as the author is aware, little research has been conducted on this topic previously.

The literature review describes three mainstream theories of capital structure and derives testable hypotheses for each theory.

The methodology used to test the hypotheses is a mixture of previously used methodologies and newly developed methodologies. A unique panel dataset of large multinational corporations from the US and the UK was collected specifically for this thesis. Econometrics methods were used to test the validity of each capital structure theory and to identify differences between the US and the UK.

The results were analysed and differences between the US and the UK were discussed in the context of previous research.

Word count = 14901

Table of contents

Introduction 1

Background 1

Research question 1

Literature review 3

Modigliani-Miller theorem 3

Assumptions 3

Example 3

Theorem 5

Implications 8

Trade-off theory 10

Observations 10

Theory 13

Implications 14

Pecking order theory 15

Observations 16

Theory 16

Implications 18

Methodology 20

Dataset 20

Model estimation 23

Hypothesis testing 24

Empirical evidence 26

Descriptive statistics 26
Modigliani-Miller theorem 26
Trade-off theory 29
Pecking order theory 32

Analysis 35
Modigliani-Miller theorem 35
Findings 35
Discussion 35
Trade-off theory 36
Findings 36
Discussion 37
Pecking order theory 38
Findings 39
Discussion 39

Conclusion 41

Bibliography 42

Introduction

Background

Capital structure is the way in which a corporation decides to finance their projects, investments and more generally assets. (Brealey et al., 2016)

Most corporations use equity securities such as shares or debt securities such as loans to raise cash. Some corporations also use hybrid securities such as preferred shares or convertible bonds.

Previous research has identified factors which influence the capital structure decisions of corporations. These factors are discussed in the literature review.

This thesis investigates whether the choice of legal domicile influences capital structure decisions.

Corporations are based or more specifically incorporated in different jurisdictions known as legal domiciles. Various factors influence the legal domicile choice of corporations. The choice of legal domicile influences the laws which determine the rights and responsibilities of corporations. (Collins, 1978) For example, in the US, it is a public perception that many corporations have incorporated in the state of Delaware because of a favourable tax regime. In the EU, a similar perception applies to countries such as Ireland, Luxembourg and also the UK. Furthermore, legal domicile choice gives a corporation access to the professional services industry developed in a jurisdiction. (Lee, 2000; Maru File et al., 1994; Saxenian, 1983) For example, Silicon Valley in California, US is known for the technology corporations which are based there. Over time a professional services industry or ecosystem has developed around technology corporations in Silicon Valley. This ecosystem makes the location even more attractive for technology corporations.

Research question

This thesis examines whether observed variation in legal domicile choice influence the capital structure decisions of corporations.

The primary research question of this thesis is:

What effect does the choice of legal domicile have on the capital structure decisions of multinational corporations?

This research question has an auxiliary which is:

Why does the choice of legal domicile influence the capital structure decisions of multinational corporations?

The questions are answered using both a theoretical and an empirical approach.

First, a literature review is conducted to identify relevant theories of capital structure. Only the Modigliani-Miller theorem, the trade-off theory and the pecking order theory are considered since they are normative and can be used to derive policy recommendations. Other theories exist but they tend to be positive theories which do not lead to policy recommendations which can be tested empirically.

Second, empirical evidence is collected and analysed. The predictions of each capital structure theory are evaluated and differences between jurisdictions are identified.

Finally, the results of the analysis are discussed and compared with previous evidence.

Literature review

Modigliani-Miller theorem

The Modigliani-Miller theorem is often the starting point of discussions about capital structure. The theorem was derived by Modigliani and Miller and published in the 1958 paper "The cost of capital, corporation finance and the theory of investment". It states that, under the assumption of perfect capital markets, the value of a corporation does not depend on the capital structure. For this reason, the theorem is alternatively known as the capital structure irrelevance principle.

Assumptions

The Modigliani-Miller theorem assumes perfect capital markets. Perfect capital markets are capital markets which have three properties.

First, investors and corporations can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.

Second, there are no taxes, transaction costs or issuance costs associated with security trading.

Third, a corporations capital structure decisions do not change the cash flows generated by its investments nor do they reveal new information about them.

Example

The main insights of the Modigliani-Miller theorem are best illustrated with an example. The example below has been adapted from lecture slides from the "Economics of Corporate Finance and Financial Markets" undergraduate course at the University of East Anglia. (A. Jackson, Personal communication, 2016)

Suppose that an entrepreneur wants to set up a new corporation which requires an initial investment of 800$. For simplicity, assume that the corporation will only be active for one year and is liquidated at the end of the year. The new corporation is risky and the income it generates depends on the future state of the economy. The economy could be in a "Strong" state with a 50% probability or a "Weak" state with a 50% probability. If the economy is in the "Strong" state, then the corporation can be liquidated for 1400$. If the economy is in the "Weak" state, then the corporation can be liquidated for 900$. Assume that the risk-free rate is 5% and that investors demand a risk-premium of 10%.

Initial investment	Liquidation	
	Strong economy	Weak economy

Cash flow	Cash flow	Cash flow
-800$	1400$	900$

Table 1 : Modigliani-Miller theorem example (A. Jackson, Personal communication, 2016)

The required return of the corporation is $5\% + 10\% = 15\%$ and the net present value of the corporation is $-800 + \frac{0.5*1400+0.5*900}{1+0.15} = 200\$$. If the entrepreneur decides to finance the corporation entirely by equity, then in perfect capital markets the market value of the unlevered equity is $\frac{0.5*1400+0.5*900}{1+0.15} = 1000\$$. In other words, the entrepreneur can raise 1000$ by selling shares to investors, invest the required 800$ and keep 200$ for themselves.

	Initial investment	Liquidation				
		Strong economy		Weak economy		
	Value	Cash flow	Return	Cash flow	Return	Expected return
Unlevered equity	1000$	1400$	40%	900$	-10%	0.5*40%+0.5*(-10%) = 15%

Table 2 : Modigliani-Miller theorem example (A. Jackson, Personal communication, 2016)

Investors will only invest in the unlevered equity if they expect to receive at least their required return of 15%. The expected return of the unlevered equity is $0.5 * 40\% + 0.5 * (-10\%) = 15\%$ so investors will invest in the corporation. The expected return must in fact be equal to the required return because if it is lower then the investors will not invest and if it is higher then the entrepreneur could keep more cash for themselves.

Suppose instead that the entrepreneur decides to finance 500$ of the initial investment by borrowing. Debt has priority over equity so at liquidation the lenders will receive their cash before any equity holders. For simplicity, assume that the debt is risk-free. In other words, assume that the debt and interest can be paid back in full in both states of the economy. Because the debt is risk-free, the interest rate is equal to the risk-free rate of 5%. The total amount to be paid back is equal to $500 * (1 + 0.05) = 525\$$ in both states of the economy. The remaining cash is distributed to equity holders.

	Initial investment	Liquidation				
		Strong economy		Weak economy		
	Value	Cash flow	Return	Cash flow	Return	Expected return
Debt	500$	500*(1+0.05) = 525$	5%	500*(1+0.05) = 525$	5%	0.5*5%+0.5*5% = 5%
Levered equity	?	1400-525 = 875$	?	900-525 = 375$	?	?
Total	?	1400$	?	900$	?	?

Table 3 : Modigliani-Miller theorem example (A. Jackson, Personal communication, 2016)

What should be the market value of the levered equity? Modigliani and Miller argued that leverage should not affect the total market value of the corporation because it does not change the cash flows generated by the corporation. The total market value of the corporation should be equal to the market value of the unlevered equity. The market value of the levered equity is therefore $1000 - 500 = 500\$$.

	Initial investment	Liquidation	

		Strong economy		Weak economy		
	Value	Cash flow	Return	Cash flow	Return	Expected return
Debt	500$	525$	5%	525$	5%	5%
Levered equity	1000-500 = 500$	875$	75%	375$	-25%	0.5*75%+0.5*(-25%) = 25%
Total	1000$	1400$	40%	900$	-10%	0.5*40%+0.5*(-10%) = 15%

Table 4 : Modigliani-Miller theorem example (A. Jackson, Personal communication, 2016)

The key principle which underlies the Modigliani-Miller theorem is that equity becomes riskier as leverage increases. The required return of the levered equity is equal to $0.5 * 75\% + 0.5 * (-25\%) = 25\%$. Under perfect capital markets, the total market value of the corporation is $\frac{0.5*525+0.5*525}{1+0.05} + \frac{0.5*875+0.5*375}{1+0.25} = 1000\$$ and is equal to the market value of the unlevered equity.

Finally, suppose that the entrepreneur decides to only finance 200$ of the initial investment by borrowing.

	Initial investment	Liquidation				
		Strong economy		Weak economy		
	Value	Cash flow	Return	Cash flow	Return	Expected return
Debt	200$	210$	5%	210$	5%	5%
Levered equity	1000-200 = 800$	1190$	48.75%	690$	-13.75%	0.5*48.75%+0.5*(-13.75%) = 17.5%
Total	1000$	1400$	40%	900$	-10%	0.5*40%+0.5*(-10%) = 15%

Table 5 : Modigliani-Miller theorem example (A. Jackson, Personal communication, 2016)

The required return of the levered equity is equal to $0.5 * 48.75\% + 0.5 * (-13.75\%) = 17.5\%$. Because the entrepreneur borrows less, the required return of the levered equity is lower. However, because the equity is still levered, the required return is higher than the required return of the unlevered equity. Under perfect capital markets, the total market value of the corporation is $\frac{0.5*525+0.5*525}{1+0.05} + \frac{0.5*1190+0.5*690}{1+0.175} = 1000\$$ which is again equal to the market value of the unlevered equity.

Theorem

The Modigliani-Miller theorem consists of two propositions known as the Modigliani-Miller propositions.

The first proposition states that in a perfect capital market, the total value of a corporation is equal to the market value of the total cash flows generated by its assets and is not affected by its capital structure decisions (Modigliani & Miller, 1958).

Let E denote the market value of levered equity, D denote that market value of debt, U denote the market value of unlevered equity and A denote the market value of the corporations assets.

$E + D = U = A$

In the example, this proposition was used to determine the market value of the levered equity.

$D = 500\$, U = 1000\$ \therefore E = 1000 - 500 = 500\$$

$D = 200\$, U = 1000\$ \therefore E = 1000 - 200 = 800\$$

Modigliani and Miller proved the first proposition using an arbitrage argument.

Suppose that the entrepreneur from the example chooses to finance the corporation entirely with equity with 1000$ of unlevered equity. Suppose also that an investor would have preferred to invest in a levered corporation with 500$ of debt and 500$ of levered equity. Under the assumption of perfect capital markets, the investor can create a portfolio which replicates the cash flows of the levered corporation by purchasing 1000$ of unlevered equity and borrowing 500$ at the risk-free rate. Creating such a portfolio is known as homemade leveraging.

	Initial investment	Liquidation	
		Strong economy	Weak economy
Replicating portfolio	Cost	Cash flow	Cash flow
Buy unlevered equity	1000$	1400$	900$
Borrow	-500$	-525$	-525$
= Buy levered equity	1000-500 = 500$	875$	375$

Table 6 : Homemade leverage (A. Jackson, Personal communication, 2016)

Suppose instead that the entrepreneur from the example chooses to finance the corporation with 500$ of debt and 500$ of levered equity. Suppose also that an investor would have preferred to invest in an unlevered corporation with 1000$ of unlevered equity. Under the assumption of perfect capital markets, the investor can replicate the payoffs of the unlevered corporation by purchasing 500$ of levered equity and lending $ 500 at the risk-free rate. Creating such a portfolio is known as homemade de-leveraging.

	Initial investment	Liquidation	
		Strong economy	Weak economy
Replicating portfolio	Cost	Cash flow	Cash flow
Buy levered equity	500$	875$	375$
Lend	500$	525$	525$
= Buy unlevered equity	500+500 = 1000$	1400$	900$

Table 7 : Homemade de-leverage (A. Jackson, Personal communication, 2016)

Finally, suppose that there exist two corporations exactly like the one in the example. The corporations are identical except for their capital structures. One corporation is unlevered with 990$ of unlevered equity and the other is levered with 500$ of risk-free debt and 510$ of levered equity. Because both corporations have identical assets, their total market values should be equal. However, the total market value of the unlevered corporation is 990$ and the total market value of the levered corporation is $500 + 510 = 1010\$$. The market valuations of these

corporations therefore contradict the first proposition. The unlevered equity of the unlevered corporation is relatively cheap and the levered equity of the levered corporation is relatively expensive.

Modigliani and Miller showed that such a contradiction leads to an arbitrage opportunity. The cash flows of the levered equity of the levered corporation can be replicated by buying the unlevered equity of the unlevered corporation for 990$ and borrowing 500$ at the risk-free rate. An arbitrage portfolio can then be created by selling short the levered equity of the levered corporation for 510$.

	Initial investment	Liquidation	
		Strong economy	Weak economy
Arbitrage portfolio	Cash flow	Cash flow	Cash flow
Buy unlevered equity	-990$	1400$	900$
Borrow	500$	-525$	-525$
Sell levered equity	510$	-875$	-375$
Total	20$	0$	0$

Table 8 : Modigliani-Miller arbitrage argument (A. Jackson, Personal communication, 2016)

The arbitrage portfolio generates a riskless profit of 20$. In perfect capital markets, investors will seek to take advantage of the arbitrage opportunity which drives the price of the unlevered corporation up and the price of the levered corporation down. An arbitrage opportunity exists if the market valuations do not conform to the first Modigliani-Miller proposition. Therefore, the market value of the unlevered equity will increase and the market value of the levered equity will decrease until the total market values of both corporations are equal and the first Modigliani-Miller proposition holds.

The arbitrage argument also holds if the unlevered equity of the unlevered corporation is relatively expensive at 1010$ and the levered equity of the levered corporation is relatively cheap at 490$. The cash flows of the unlevered equity of the unlevered corporation can be replicated by buying the levered equity of the levered corporation for 490$ and lending 500$ at the risk-free rate. An arbitrage portfolio can then be created by selling short the unlevered equity of the unlevered corporation for 1010$.

	Initial investment	Liquidation	
		Strong economy	Weak economy
Arbitrage portfolio	Cash flow	Cash flow	Cash flow
Buy levered equity	-490$	875$	375$
Lend	-500$	525$	525$
Sell unlevered equity	1010$	-1400$	-900$
Total	20$	0$	0$

Table 9 : Modigliani-Miller arbitrage argument (A. Jackson, Personal communication, 2016)

The second proposition states that if the first proposition holds, then the cost of capital of levered equity increases with a corporations market value debt-to-equity ratio. (Modigliani & Miller, 1958)

Let R_E denote the expected return of levered equity, R_D denote the expected return of debt and R_U denote the expected return of unlevered equity.

$$\frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_U$$

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

This proposition can be used to calculate the expected return of levered equity for any capital structure if R_D and R_U are known.

In the example, $R_D = 5\%$ and $R_U = 15\%$ so $R_E = 15\% + \frac{D}{E}(15\% - 5\%) = 15\% + \frac{D}{E}10\%$. This equation can be used to verify the results of the example.

$$D = 0\$, E = 1000\$ \therefore R_E = 15\% + \frac{0}{1000}10\% = 15\%$$

$$D = 500\$, E = 500\$ \therefore R_E = 15\% + \frac{500}{500}10\% = 15\% + 10\% = 25\%$$

$$D = 200\$, E = 800\$ \therefore R_E = 15\% + \frac{200}{800}10\% = 15\% + 2.5\% = 17.5\%$$

Modigliani and Miller showed that the second proposition follows logically from the first proposition. The proof is mathematical and does not provide new insights, so it is not included in this thesis.

Finally, Modigliani and Miller showed that the weighted average cost of capital of a corporation is given by the following formula. The weighted average cost of capital is the weighted average of the required return of shareholders and the required return of creditors. It represents the minimum expected return of the corporations assets which allows the corporation to attract investors.

$$R_{WACC} = R_U = \frac{E}{E+D}R_E + \frac{D}{E+D}R_D$$

Implications

The Modigliani-Miller theorem suggests that capital structure is irrelevant. If the theorem holds, then corporations and investors should be indifferent between different capital structures.

In this thesis it is proposed that the following interpretation can be given to the Modigliani-Miller theorem.

Let A_t denote the market value of the assets of a corporation at discrete time t and ΔA_t denote the market value of a marginal investment at discrete time t.

$$A_t = A_{t-1} + \Delta A_t$$

Furthermore, let E_t denote the market value of the corporations equity at discrete time t, ΔE_t denote the marginal equity issue at discrete time t, D_t denote the market value of the corporations debt at discrete time t and ΔD_t denote the marginal debt issue at discrete time t.

$E_t = E_{t-1} + \Delta E_t$

$D_t = D_{t-1} + \Delta D_t$

The first Modigliani-Miller proposition implies that $\Delta E_t + \Delta D_t = \Delta A_t$. Therefore, suppose that the corporation can fund a marginal investment either fully by equity or fully by debt. According to the Modigliani-Miller theorem, the probability that the marginal investment is funded by equity should be equal to the probability that the marginal investment is funded by debt.

If the Modigliani-Miller theorem holds, then the debt-to-equity ratio should converge to 1 over time.

$\lim_{t\to\infty} \frac{D_t}{E_t} = 1$

If the probability of equity issues remains equal to the probability of debt issues, then equity and debt will tend to be highly correlated and follow the same increasing trend. Furthermore, if the distribution of new investments remains constant over time, then new investments will represent a smaller and smaller proportion of equity and debt. Therefore, the debt-to-equity ratio will converge towards 1 because the effects of new investments on the debt-to-equity ratio will become smaller and smaller.

The rate at which the debt-to-equity ratio tends to converge to 1 can be measured empirically using a target-adjustment model. (Shyam-Sunder & Myers, 1999) The model was originally developed to test another theory of capital structure, the trade-off theory, but has been adapted for the Modigliani-Miller theorem. In the context of the Modigliani-Miller theorem, the name target-adjustment model is a misnomer because corporations do not explicitly seek to have a debt-to-equity ratio equal to 1 but the target is instead a consequence of the indifference between equity and debt.

$\frac{D_t}{E_t} - \frac{D_{t-1}}{E_{t-1}} = \beta_0 + \beta_1 \left(1 - \frac{D_{t-1}}{E_{t-1}}\right) + u_t$

The coefficient β_0 is the intercept and the coefficient β_1 is the convergence rate. The residual u_t represents unexpected changes in the debt-to-equity ratio.

The model can be estimated using ordinary least squares estimation. The debt-to-equity ratio tends to approach 1 if $\beta_1 > 0$ and $\beta_1 < 1$.

The target-adjustment model can be estimated using cross-sectional, time-series or panel data. For this thesis, the model is estimated using pooled panel data. This implies that the convergence rate is a measure of the average convergence rate across all groups. It would be more appropriate to estimate the model using time-series data because this would measure the convergence rate of a single group. However, the pooled panel data estimates are useful as first estimates.

$\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}} = \beta_0 + \beta_1 \left(1 - \frac{D_{t-1,i}}{E_{t-1,i}}\right) + u_{t,i}$ where i indexes groups

Furthermore, the estimated model is in fact an extended version of the target-adjustment model. To investigate differences between the US and the UK, the model is extended by including a dummy variable $US_{t,i}$ equal to 1 if the legal domicile of a corporation is in the US and 0 otherwise. An interaction variable of the two independent variables is also included.

$$\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}} = \beta_0 + \beta_1\left(1 - \frac{D_{t-1,i}}{E_{t-1,i}}\right) + \beta_2 US_{t,i} + \beta_3\left(1 - \frac{D_{t-1,i}}{E_{t-1,i}}\right) US_{t,i} + u_{t,i}$$

In this model, the debt-to-equity ratio of UK corporations tends to approach 1 if $\beta_1 > 0$ and $\beta_1 < 1$ while the debt-to-equity ratio of US corporations tends to approach 1 if $\beta_1 + \beta_3 > 0$ and $\beta_1 + \beta_3 < 1$.

Trade-off theory

The trade-off theory is a theory of capital structure which relaxes one of the assumptions of the Modigliani-Miller theorem. It was developed by Kraus and Litzenberger and published in the 1973 paper "A state-preference model of optimal financial leverage". The trade-off theory assumes imperfect capital markets because it introduces taxes and financial distress costs. These assumptions violate the third assumption of perfect capital markets because they imply that capital structure decisions do change the cash flows generated by the investments of a corporation. The theory states that there exists an optimal capital structure which maximizes the value of a corporation.

Observations

The trade-off theory is based on two observations which contradict the assumptions of perfect capital markets. The presentation of the observations below is adapted from lecture slides from the "Economics of Corporate Finance and Financial Markets" undergraduate course at the University of East Anglia. (A. Jackson, Personal communication, 2016)

The first observation made in the trade-off theory is that corporate income taxes create an advantage for corporations which use debt. Because interest expenses are paid before taxes, corporate income taxes reduce the amount of tax paid by a corporation.

Income statement		
	Without leverage	With leverage
Earnings before interest and taxes (EBIT)	2500$	2500$
Interest expense	0$	-430$
Income before tax	2500+0 = 2500$	2500-430 = 2070$
Tax (35%)	-0.35*2500 = -875$	-0.35*2070 = -725$
Net income	2500-875 = 1625$	2070-725 = 1345$

Table 10 : Interest tax shield example (A. Jackson, Personal communication, 2016)

Leverage reduces net income for shareholders. However, the total amount paid to all investors is higher with leverage than without leverage.

0+1625 = 1625$ without leverage

430+1345 = 1775$ with leverage

The difference in the total cash flow to investors 1775-1625 = 150$ is approximately the tax rate multiplied by the interest expense 0.35*430 ≈ 150$. The ability of corporations to reduce taxable income with interest expenses is known as the interest tax shield. Corporations can use the interest tax shield once during every fiscal year. The present value of all future interest tax shields is known as the value of the interest tax shield. The interest tax shield increases the total market value of a levered corporation compared to an unlevered corporation by the value of the interest tax shield.

Therefore, because of taxes, the first Modigliani-Miller proposition no longer holds. Leverage allows the original shareholders of a corporation to raise more cash because it increases the total cash flows available to distribute to investors and violates the assumption of perfect capital markets.

The second observation made in the trade-off theory is that there are financial distress costs associated with debt.

A default is a failure by a corporation to pay the interest of principal of a debt. In most jurisdictions, corporations may negotiate with creditors in the event of a default. For example, creditors may agree to forgive an interest payment in exchange for higher payments later. This may be a rational decision if the default is caused by short-term problems because creditors will be able to recover the loss later. Nonetheless, if the negotiations are not successful, then creditors can take legal action against a corporation in an event known as a bankruptcy proceeding. While the exact procedure varies from jurisdiction to jurisdiction, in general a bankruptcy proceeding involves halting a corporations operations and the liquidation by a government-appointed bankruptcy administrator of any remaining assets. Any cash raised in bankruptcy proceedings is used to pay creditors. If enough cash is raised to pay all debts and interests, then a corporation is no longer in default and may continue operating. Otherwise a corporation is left with no assets at all and must close for business permanently in an event known as a bankruptcy. In contrast, corporations have no obligation to pay dividends to shareholders. If a corporation fails to pay dividends, then shareholders have no right to seize control of the assets of the corporation.

Under the assumption of perfect capital markets, a bankruptcy simply shifts the ownership of a corporation from shareholders to creditors without affecting the assets of the corporation.

Suppose that an entrepreneur wants to set up a corporation. For simplicity, assume that the corporation will only be active for one year and is liquidated at the end of the year. If the corporation succeeds, then its assets will be worth 150$. If the corporation fails, then its assets will be worth 80$. The entrepreneur is considering two different capital structures. The corporation can be funded either fully by equity or fully with debt with a total repayment of interest and principal equal to 100$.

	Without leverage		With leverage	
	Success	Failure	Success	Failure
Debt value	0$	0$	100$	80$
Equity value	150$	80$	50$	0$
Total value	150$	80$	150$	80$

Table 11 : Financial distress in perfect capital markets example (A. Jackson, Personal communication, 2016)

Assume that the probability of success is equal to the probability of failure and that the risk-free rate is equal to 5%. For simplicity, suppose that the cash flows of the corporation are unrelated to the state of the economy such that the corporation has a CAPM beta of 0 and the cost of capital

is equal to the risk-free rate. The corporation is risky but according to the CAPM, the risk can be diversified so investors do not demand a risk premium. Perhaps another corporation will succeed if the corporation fails and vice versa.

Without leverage, shareholders own the assets of the company and receive 150$ in the "Success" state and 80$ in the "Failure" state. In perfect capital markets, the market value of the unlevered equity is $\frac{0.5*150+0.5*80}{1+0.05} = 109.52\$$. With leverage, the corporation is in default in the "Failure" state. However, creditors still recover 80$ from the 100$ they are due. In the "Success" state, the entrepreneur gets to keep 50€ of levered equity after repaying the debt. In perfect capital markets, the market value of the levered equity is $\frac{0.5*50+0.5*0}{1+0.05} = 23.81\$$ and the market value of the debt is $\frac{0.5*100+0.5*80}{1+0.05} = 85.71\$$. The total market value of the levered corporation is 23.81+85.71 = 109.52$ and is equal to the market value of the unlevered corporation. The first Modigliani-Miller proposition holds in this example. The capital structure decision of the entrepreneur does not change the total market value of the corporation.

In practice, however, there are significant costs associated with defaults. Negotiations and bankruptcy proceedings are always costly. Corporations must use remaining assets to pay fees to outside experts such as lawyers, accountants and consultants. Furthermore, there are also indirect costs. A corporation in default may lose the trust of employees and suppliers who fear that they will not be paid. Furthermore, consumers may lose trust in a corporation in default. Consumers may for example expect the quality of the goods produced by a corporation in default to decrease because of cost-cutting. Moreover, corporations which operate a pre-paid business model may find it difficult to convince customers to buy their goods and services because there is a risk that the company will not fulfil their obligations. Finally, a corporation in default may seek to liquidate assets quickly which may result in assets being sold at a loss.

Suppose that an entrepreneur wants to set up a corporation like the one in the the previous example. For simplicity, assume that the corporation will only be active for one year and is liquidated at the end of the year. If the corporation succeeds, then its assets will be worth 150$. If the corporation fails, then its assets will be worth 80$. The entrepreneur is considering two different capital structures. The corporation can be funded either fully by equity or fully with debt with a total repayment of interest and principal equal to 100$. However, suppose that if the corporation defaults on the debt then it will incur financial distress costs of 20€.

	Without leverage		With leverage	
	Success	Failure	Success	Failure
Debt value	0$	0$	100$	80-20 = 60$
Equity value	150$	80$	50$	0$
Total value	150$	80$	150$	60$

Table 12 : Financial distress in imperfect capital markets example (A. Jackson, Personal communication, 2016)

Again, assume that the probability of success is equal to the probability of failure, the risk-free rate is equal to 5% and for simplicity suppose that the cash flows of the corporation are unrelated to the state of the economy such that the corporation has a CAPM beta of 0 and the cost of capital is equal to the risk-free rate.

The market value of the unlevered equity is $\frac{0.5*150+0.5*80}{1+0.05} = 109.52\$$. The market value of the levered equity is $\frac{0.5*50+0.5*0}{1+0.05} = 23.81\$$ and the market value of the debt is $\frac{0.5*100+0.5*60}{1+0.05} = 76.19\$$. The total market value of the levered corporation is 23.81+76.91=100$ and is less than the market value of the unlevered equity. The difference between the value of the unlevered

corporation and the value of the levered corporation 109.52-100 = 9.52$ is equal to the present value of the financial distress costs $\frac{0.5*0+0.5*20}{1+0.05} = 9.52\$$.

Therefore, because of financial distress costs, the first Modigliani-Miller proposition no longer holds. Leverage reduces that amount of cash that the original shareholders of a corporation can raise because it reduces the total cash flows available to distribute to investors in some states of the economy and violates the assumption of perfect capital markets.

Theory

The trade-off theory states that the first Modigliani-Miller proposition must be corrected to account for the value of the interest tax shield which increases the total value of the levered corporation compared to the unlevered corporation. (Modigliani & Miller, 1963; Kraus & Litzenberger, 1973)

$$E + D = U \rightarrow E + D = U + PV(Interest\ tax\ shield)$$

The present value of the interest tax shield depends on internal and external factors such as the debt-to-equity ratio, the type of debt issued by a corporation, the discount factor and the tax regime. In general, the present value of the interest tax shield should be an increasing but concave function of the debt-to-equity ratio. If a corporation is heavily indebted, then the corporation may no longer be able to use the interest tax shield because interest expenses must be offset against profits.

Another implication of the interest tax shield is that the weighted average cost of capital must also be corrected. The interest tax shield reduces the required return of debt and therefore also the weighted average cost of capital. Let τ denote the tax rate.

$$R_{WACC} = \frac{E}{E+D} R_E + \frac{D}{E+D} R_D(1-\tau)$$

The trade-off theory also states that the first-Modigliani-Miller proposition must be corrected to account for financial distress costs. (Kraus & Litzenberger, 1973)

$$E + D = U + PV(Interest\ tax\ shield) \rightarrow E + D = U + PV(Interest\ tax\ shield) - PV(Financial\ distress\ costs)$$

The present value of financial distress costs depends on internal and external factors such as the debt-to-equity ratio, the types of assets owned by a corporation, the costs of experts, the state of the economy and so on. In general, the present value of financial distress costs should be an increasing and convex function of the debt-to-equity ratio because financial distress costs only become significant once a corporation becomes heavily indebted.

The two corrections of the first Modigliani-Miller proposition imply the existence of an optimal capital structure which maximizes the total market value of a corporation at any given time.

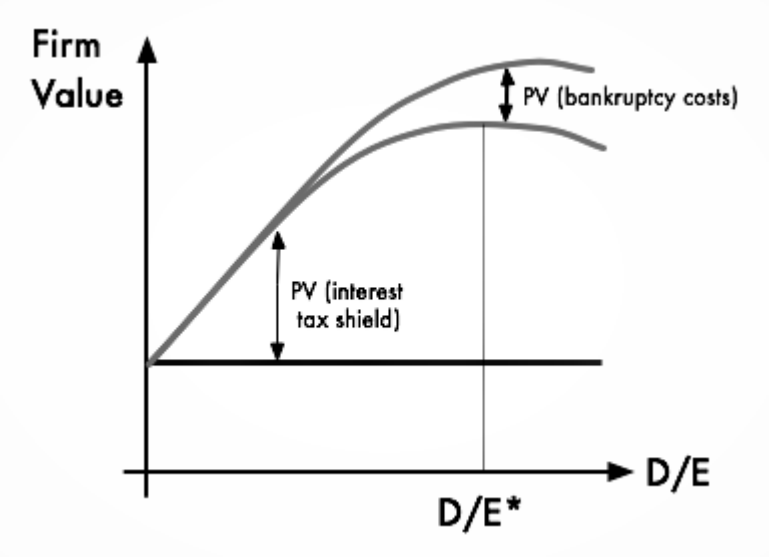

Figure 1 : Trade-off theory (https://commons.wikimedia.org/w/index.php?curid=2234433)

The theory predicts an inverted U-shaped relationship between the debt-to-equity ratio and the total market value of a corporation.

Implications

The trade-off theory suggests that capital structure is relevant. If the theory holds, then corporations should choose capital structures which maximize their total market value.

Shyam-Sunder and Myers proposed that the trade-off theory can be interpreted in terms of a target-adjustment model (Shyam-Sunder & Myers, 1999). They argued that if the theory holds then corporations always adjust the debt-to-equity ratio to maximize total market value. Random events can push the debt-to-equity ratio away from the optimal one, but corporations adjust their capital structures quickly to maximize total market value. Shyam-Sunder and Myers used a model with debt rather than debt-to-equity as the independent variable but the same reasoning applies to both cases.

Let O_t denote the optimal debt-to-equity ratio at time t.

$$\frac{D_t}{E_t} - \frac{D_{t-1}}{E_{t-1}} = \beta_0 + \beta_1 \left(O_t - \frac{D_{t-1}}{E_{t-1}} \right) + u_t$$

The coefficient β_0 is the intercept and the coefficient β_1 is the convergence rate. The residual u_t represents unexpected changes in the debt-to-equity ratio.

Unfortunately, because the optimal debt-to-equity ratio is unobservable, the target-adjustment model cannot be estimated. One possible solution is to use the sample mean debt-to-equity ratio as the optimal debt-to-equity ratio. This specification assumes that the target is constant during the sample period. Another specification is to use a moving average as the target. This specification allows for a changing target.

Because the choice of specification is arbitrary, tests of the trade-off theory and the target adjustment model can be misleading. Shyam-Sunder and Myers showed through simulations that

the target-adjustment model may seem to be statistically significant even if capital structure decisions have been generated by following another theory, the pecking order theory. They argued that fluctuations in corporations capital expenditures are positively serially correlated and that corporations operating earnings are cyclical. Since dividends are sticky and not used as a short-run offset to net funds requirements, corporations tend to go through periods of financial deficits followed by periods of financial surpluses, or vice versa. According to the pecking order theory, the debt-to-equity ratio increases in deficit years and decreases in surplus years. If the sample mean debt-to-equity ratio is used as the optimal debt-to-equity ratio, then the debt-to-equity ratios implied by the pecking order theory will exhibit mean-reversion and the target-adjustment model will falsely seem significant. (Shyam-Sunder & Myers, 1999)

Nonetheless, the model can be estimated using ordinary least squares estimation if the optimal debt-to-equity ratio is specified. The debt-to-equity ratio tends to approach the optimal debt-to-equity ratio if $\beta_1 > 0$ and $\beta_1 < 1$.

The target-adjustment model can be estimated using cross-sectional, time-series or panel data. For this thesis, the model is estimated using pooled panel data. This implies that the convergence rate is a measure of the average convergence rate across all groups. It would be more appropriate to estimate the model using time-series data because this would measure the convergence rate of a single group. However, the pooled panel data estimates are useful as first estimates.

$\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}} = \beta_0 + \beta_1 \left(O_{t,i} - \frac{D_{t-1,i}}{E_{t-1,i}} \right) + u_{t,i}$ where i indexes groups

Furthermore, the estimated model is in fact an extended version of the target-adjustment model. To investigate differences between the US and the UK, the model is extended by including a dummy variable $US_{t,i}$ equal to 1 if the legal domicile of a corporation is in the US and 0 otherwise. An interaction variable of the two independent variables is also included.

$$\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}} = \beta_0 + \beta_1 \left(O_{t,i} - \frac{D_{t-1,i}}{E_{t-1,i}} \right) + \beta_2 US_{t,i} + \beta_3 \left(O_{t,i} - \frac{D_{t-1,i}}{E_{t-1,i}} \right) US_{t,i} + u_{t,i}$$

In this model, the debt-to-equity ratio of UK corporations tends to approach the optimal debt-to-equity ratio if $\beta_1 > 0$ and $\beta_1 < 1$ while the debt-to-equity ratio of US corporations tends to approach the optimal debt-to-equity ratio if $\beta_1 + \beta_3 > 0$ and $\beta_1 + \beta_3 < 1$.

Pecking order theory

The pecking order theory is a theory of capital structure which relaxes one of the assumptions of the Modigliani-Miller theorem. It was originally suggested by Donaldson in the 1961 book “Corporate debt capacity: A study of corporate debt policy and the determination of corporate debt capacity” and later modified by Myers and Majluf in the 1984 paper “Corporate financing and investment decisions when corporations have information that investors do not have”. The pecking order theory assumes imperfect capital markets because it introduces asymmetric information. This assumption violates the third assumption of perfect capital markets because it implies that capital structure decisions do reveal new information about the cash flows generated by the investments of corporations. The theory states that there is no optimal capital structure but

that corporations have a preference ordering of capital issues starting from internal funds then debt and finally equity.

Observations

The pecking order model is based on an observation about the behaviour of corporations which contradicts the Modigliani-Miller theorem and the trade-off theory.

Donaldson observed that corporations prioritize different sources of funding based on their costs. (Donaldson, 1961)

Internal funding, essentially excess cash, is the cheapest because it is available for use immediately and with only minimal costs. Corporations therefore prefer internal funding to other types of funding.

Debt is the second cheapest because it is a safer investment than equity and it does not necessarily involve fees which are associated with equity issuances since debt can be obtained from banks. If corporations need to raise external funding, they prefer debt to equity.

Equity is the most expensive form of funding because it is unsecured and often involves fees. For this reason, corporations only issue equity as a last resort.

Theory

The following explanation of the pecking order theory is a simple version developed by Myers. (Myers, 1984) The theory is a theoretical explanation of the observed prioritization of different sources of financing. The simple version only describes the main insights of the theory. A more complete theory was developed by Myers and Majluf but is not considered in this thesis because it essentially leads to the same insights (Myers & Majluf, 1984)

Suppose that a corporation needs to raise N dollars to undertake a potentially profitable investment opportunity. Let y denote the net present value of the opportunity and x denote the value of the corporation if the investment is not undertaken. The managers of the corporation know the true values of x and y while investors only know the joint distribution of possible values $(\tilde{x}, \tilde{y})$. In other words, managers have inside information and there is an information asymmetry with respect to investors in capital markets.

Aside from the information asymmetry, capital markets are assumed to be perfect and semi-strong form efficient. The Modigliani-Miller proposition holds in this setting if the information available to investors is held constant.

The corporation stands to benefit by the net present value y by raising N dollars. However, the corporation may have to sell securities for less than they are worth. Suppose that the corporation sells shares for a total of N dollars but managers know that the shares are worth N_1 dollars because they have information that investors do not have. For now, only equity is considered even

though the same reasoning applies to any type of security. Managers may pursue many different objectives in this situation. (Myers & Majluf, 1984) However, in the simplified theory, Myers argues that the most logical objective is to maximize the true value also known as the intrinsic value of the corporations existing shares. In other words, managers work on behalf of the existing shareholders of the corporation. Investors know that managers act in this way. Most of all, new investors know that managers are not acting on their behalf so they will adjust the price they are willing to pay for shares.

Let $\Delta N = N_1 - N$ denote the amount by which the shares are under-valued. If ΔN is positive, then the shares are under-valued If ΔN is negative, then the shares are over-valued. The managers will only issue new shares and undertake the investment opportunity if the following decision rule holds.

$y \geq \Delta N$

If managers know that the shares are over-valued, then they will always issue shares even if the new funds are placed in the bank which is a zero net present value investment. However, if managers know that the shares are under-valued, then they would rather not undertake a positive net present value opportunity than issue under-valued shares.

If managers act in this way, then a share issuance is always a negative signal to both old and new investors. Let V denote the market value of the corporation if it does not issue new shares and V' denote the market value if it does issue new shares. If everyone knows that investors follow the decision rule, then a rational expectations equilibrium must satisfy the following conditions.

$V = E[\tilde{x}|No\ issue] = E[\tilde{x}|y < \Delta N]$

$V' = E[\tilde{x} + \tilde{y} + N|Issue] = E[\tilde{x} + \tilde{y} + N|y \geq \Delta N]$

This result is an application of the market for lemons model and the adverse selection principle. (Akerlof, 1978)

The total funding raised is a constant, but the number of new shares needed to raise that amount is not. The required number of new shares is $\frac{N}{Share\ price}$. Therefore, ΔN is endogenous and depends on V'. If the corporation issues shares, then the fraction of shares held by new shareholders is $\frac{N}{V'}$. The managers know that the true value of the new shareholders shares is given by the following expression.

$N_1 = \frac{N}{V'}(x + y + N)$

Therefore, given N, x and y, if the shares are issued then the value given up to new shareholders and therefore also ΔN are decreasing functions of the share price.

The pecking order theory implies a preference ordering of funding types.

First, the pecking order theory identifies a cost of using external funding. Usually, the costs of external funding is defined in terms of explicit costs such as administrative and underwriting costs. However, internal funding can also involve such costs. Asymmetric information implies a different kind of cost because corporations may fail to undertake positive net present value investment opportunities because they do not want to issue under-priced securities. However, this problem

does not exist for internal funds. Therefore, the pecking order theory predicts that corporations retain enough excess cash to cover the funding needs of positive net present value investment opportunities.

Second, the pecking order theory identifies an advantage of debt issues over equity issues. In general, the pecking order theory predicts that corporations issue safer securities before issuing riskier securities.

As shown earlier, corporations only invest if the net present value of an investment opportunity is greater than the amount by which the new shares are under-valued. For example, let an investment opportunity require $N = 100\$$ but a corporation can only sell shares which are truly worth $N_1 = 120\$$. The corporation will only undertake the investment opportunity if the net present value is at least $120 - 100 = 20\$$. If the investment opportunity has a net present value of $15\$$ then the corporation will not invest. In this case, the intrinsic value of the corporation is reduced by 15$ even though the old shareholders gain 5$.

This problem could have been avoided by having enough cash reserves. Unfortunately, it is not always possible to maintain enough cash reserves. If managers want to undertake the investment opportunity, then they must reduce ΔN.

The managers can consider issuing safer securities instead. Safer securities are securities whose future value changes less when managers inside information becomes public knowledge. If the corporation can issue risk-free debt, then ΔN is equal to zero and the corporation should never fail to undertake a positive net present value investment opportunity. Even if corporations issue risky debt, ΔN should always be lower than in the case of equity because debt has priority over equity in a default. In a default, creditors will be able to recover at least a portion of their investment while shareholders will be left with nothing.

This example assumed that managers know that securities are under-valued. If managers know that securities are over-valued, then managers will prefer issuing equity or riskier securities such as warrants. This implies that managers should issue debt when the corporation is under-valued and equity or other risky securities when the corporation is over-valued.

However, this decision rule is problematic. If investors expect this behaviour, then they will refuse to buy equity until the corporation has fully exhausted the available debt funding in the market. Therefore, investors would force the corporation to use the pecking order of internal funding, safe securities and risky securities.

Implications

The pecking order theory suggests that capital structure is relevant but that there is no optimal capital structure. If the theory holds, then corporations are expected to use debt to cover financing needs and only issue equity as a last resort.

Shyam-Sunder and Myers proposed that the pecking order theory can be interpreted in terms of a flow of funds deficit model (Shyam-Sunder & Myers, 1999). They argued that if the theory holds then corporations always use debt to cover funding deficits.

Let DEF_t denote the fund flow deficit at time t, DIV_t denote dividend payments at time t, X_t denote capital expenditures at time t, ΔW_t denote the net increase in working capital at time t, R_t denote the current portion of long-term debt at time t and C_t denote operating cash flows after interest and taxes at time t.

The fund flow deficit is the amount of cash that a corporation needs to raise externally to cover their cash needs. It is given by the following formula.

$$DEF_t = DIV_t + X_t + \Delta W_t + R_t - C_t$$

The pecking order model predicts that the fund flow deficit is almost always financed by debt and equity is only ever used as a last resort. If the deficit is positive, then debt is used to raise cash. Conversely, if the deficit is negative, then debt is retired by spending cash.

This behaviour can be modelled using the model below.

$$D_t - D_{t-1} = \beta_0 + \beta_1 DEF_t + u_t$$

The coefficient β_0 is the intercept and the coefficient β_1 is the proportion of the deficit which is financed by debt. The residual u_t represents unexpected changes in the level of debt.

The model can be estimated using ordinary least squares estimation. The trade-off theory predicts that $b_0 = 0$ and $\beta_1 = 1$ because corporations prefer debt and only issue equity as a last resort.

The pecking order model can be estimated using cross-sectional, time-series or panel data. For this thesis, the model is estimated using pooled panel data. This implies that the proportion of debt funding is a measure of the average proportion across all groups. It would be more appropriate to estimate the model using time-series data because this would measure the convergence rate of a single group. However, the pooled panel data estimates are useful as first estimates.

$D_{t,i} - D_{t-1,i} = \beta_0 + \beta_1 DEF_{t,i} + u_{t,i}$ where i indexes groups

Furthermore, the estimated model is in fact an extended version of the target-adjustment model. To investigate differences between the US and the UK, the model is extended by including a dummy variable $US_{t,i}$ equal to 1 if the legal domicile of a corporation is in the US and 0 otherwise. An interaction variable of the two independent variables is also included.

$$D_{t,i} - D_{t-1,i} = \beta_0 + \beta_1 DEF_{t,i} + \beta_2 US_{t,i} + \beta_3 DEF_{t,i} US_{t,i} + u_{t,i}$$

In this model, the pecking order theory predicts that $\beta_0 = 0$ and $\beta_1 = 1$ for UK corporations whereas it predicts that $\beta_0 + \beta_2 = 0$ and $\beta_1 + \beta_3 = 1$ for US corporations.

Methodology

Dataset

A panel of 50 multinational corporations was observed at the end of fiscal years 2016, 2017, 2018 and 2019.

25 corporations were chosen from the US and 25 corporations were chosen from the UK. The choice of corporations is based on the Forbes Global 2000 ranking of the largest public corporations by a combination of four factors: sales, profit, assets and market value. The ranking is created annually by Forbes Magazine. The factors and their relative importance are arbitrary. However, Forbes tries to construct the ranking in way which reflects the true size of the corporations. A single factor may give an inaccurate picture of the scale of the corporations. Using the combined factors gives a more stable ranking that reflects the true size of the corporations The corporations included in the sample are the 25 top-ranking US and UK corporations in the ranking.

The sample contains corporations from many industries and represents a large portion of publicly traded corporations by value. However, it is not a perfectly random sample because it only contains large corporations. Nonetheless, the sample is considered representative of large multinational corporations.

Data was collected from the annual reports of the chosen corporations.

Corporate annual reports are reports which corporations publish annually to investors. They often contain a large amount of information and can be hundreds of pages long. This is the first problem faced when collecting data for this thesis. Because there is so much information, it is difficult to distinguish the relevant information from the irrelevant information. Nonetheless, annual reports always contain financial statements for the year. Using these financial statements, especially the balance sheet and the cash flow statement, it is possible to calculate all the variables needed to estimate the capital structure models described earlier.

Balance sheets were used to calculate the book value of equity and the book value of debt. These variables are used as proxies for the market value of equity and the market value of debt, respectively. The book values are used instead of market values because the latter are difficult to observe. Data exists for all publicly traded securities issued by corporations. However, many corporations have complicated structures involving common shares, many series of preferred shares, different seniorities of debts, etc. Furthermore, many securities are not traded publicly so their market value is not even properly defined. Using book values for proxies is considered acceptable by many finance practitioners and academics. Some assets trade below their book

value and some trade above. However, because of modern accounting standards, the book value is a good measure of a fair value that would be accepted by rational investors. (Hodder et al., 2014) However, one problem with this approach is that it relies on corporations using similar accounting standards. Two identical corporations could have significantly different numbers if they use different accounting principles. Fortunately, all the corporations in the sample use generally accepted accounting principles which are an industry standard for accounting. Unfortunately, changes were made to the principles between 2017 and 2018. The revenue recognition standard was changed. This standard determines when corporations are required to declare revenues and is particularly important because of the way modern accounting works. Most corporations use what is known as accrual accounting as opposed to cash-basis accounting. Cash-basis accounting records revenue when cash is received, and expenses when they are paid in cash. Accrual accounting records revenue when they are earned as an asset and expenses when they are incurred as a liability. This is a better way of accounting because it allows for better management of a corporations finances. The changes in the standard were designed to make it easier for investors to understand the accounts of corporations by simplifying the standards and improving disclosure. Other changes included changes in the lease standard and changes in the credit loss standard. Because of these changes, it is likely that some of the variation in the data between 2017 and 2018 is due only to the changes in the accounting standards. Nonetheless, there are no large differences between the two years so this is not considered as a problem.

The book value of equity is simple to calculate using the balance sheet equation. The book value of equity, also known as the shareholder's equity, is the difference between the assets and the liabilities of a corporation. It is related to the market value of equity because it represents what the shareholders of a corporation would receive if the corporation was liquidated by selling all assets and settling all liabilities.

Using the book value of equity led to one corporation, Boeing, being dropped from the sample because it had a negative book value of equity. This is not a problem in terms of book values but is problematic as a proxy for the market value which can never be negative. Boeing was therefore dropped from the sample. The change does not affect the results of the thesis because Boeing is an outlier in the sample. The sample period contains a period in which Boeing was forced to ground a new aeroplane, the Boeing 737 MAX, because of several crashes. Because of this, Boeing was put in an unusual position. The value of their assets decreased while the value of their liabilities increased resulting in a negative book value of equity. Because of this, it is reasonable to consider Boeing as an outlier.

The book value of debt can also be calculated from the balance sheet. However, it is not as straightforward as the book value of equity. Debt is a liability which is used to finance assets. However, not all liabilities are debts. Some liabilities must be paid but are not used to finance the assets of a corporation. For example, the accounts payable to a supplier represent a liability because the supplier must be paid for the supplies. However, the accounts payable are not considered debt because they are not used to finance assets such as buildings, machinery, etc. Therefore, judgment must be used to determine which liabilities to consider as debt. Some items such as short-term and long-term financial debt are easy to include. They represent the loans and bonds of a corporation. These were the only items considered as debt for this thesis. However, nowadays, corporations can finance assets in various ways. For example, it is possible for corporations to lease assets using either an operational lease or a capital lease. Leases are like loans of physical assets but there is a debate among lawyers and accountants about how they should be treated. Essentially, an operational lease keeps the asset under the ownership of the leaser at the end of the lease while a capital lease transfers the ownership of the asset to the

lessee at the end of the lease. Under the generally accepted accounting standards, operational leases are considered as an operational expense while capital leases are considered as liabilities. Furthermore, corporations can raise cash with instruments such as repurchase agreements and reverse repurchase agreements. For instance, banks can raise cash by selling assets under a repurchase agreement which obliges them to buy the asset back at a slightly higher price. A reverse repurchase agreement is the same agreement but instead the banks buy an asset and have an obligation to sell it back at a slightly higher price. This practice is very similar to secured borrowing and lending. The asset being traded acts as collateral and the price difference represents the interest. Nonetheless, this practice is not considered as borrowing and lending under the generally accepted accounting standards. Nonetheless, repurchase agreements are considered as liabilities and reverse repurchase agreements are considered as assets. Many similar examples of financial engineering can be found. The problem with the definition of debt is that it depends on the purpose of raising funds. With large corporations, it is not always clear why a financing decision is taken. Nonetheless, for the purposes of this thesis, only financial debt is considered as debt because this is the generally accepted accounting standard.

Cash flow statements were used to calculate the fund flow deficit.

However, the fund flow deficit is difficult to calculate. Some of the variables are not easily available in annual reports. Nonetheless, corporations report the net cash flow generated by operations and the net cash flow spent on investing. The deficit is calculated as the difference between the net cash flow spent on investing and the net cash flow generated by operations. This method of calculating the deficit ignores dividend payments and debt repayments. Instead, it represents the amount of external funding needed by a corporation before any financing activities. For this reason, the results of the pecking order tests may be misleading. Nonetheless, calculating the deficit in this way gives a first impression of the cash needs of a corporation regardless of financing activities.

To make all corporations comparable, all numbers were converted to US dollars using the average exchange rates during each fiscal year.

After converting the numbers, the units of the book value of equity, the book value of debt and the fund flow deficit are millions of US dollars for all corporations in the sample.

Finally, the country of each corporation was recorded as a dummy variable and the variables required to estimate the models were calculated.

One corporation in the sample, Linde, went through a merger during the sample period. Linde Group and Praxair merged in 2018 to create Linde. The merger meant that there was no data for Linde before 2018. To solve this problem, data was collected separately from both corporations for 2016 and 2017. The numbers were then summed to estimate the numbers for the Linde corporation which did not exist at the time. The merger was interpreted as a consolidation of the balance sheets and cash flow statements of the two corporations. However, the method did not take into account that the corporations could have held each others securities and that the two corporations may have been each others clients. This should have been taken into account before summing the numbers. Nonetheless, the numbers seemed reasonable. The debt of the merged

corporation decreased slightly in 2018 and 2019 and the fund flow deficit decreased in 2018 but returned slightly below the earlier levels in 2019. The only potential problem was the equity of the merged corporation which doubled in 2018 and remained high in 2019. Nonetheless, the corporation was kept in the sample because the corporation does not seem like an outlier regardless of the merger.

The dataset was created with MS Excel.

Evidently, the dataset is not a perfect dataset and many shortcuts were used to simplify the data collection. However, sample can be considered as representative of large multinational corporations and the variables can be considered as proxies.

The first observation that can be made is that collecting data for this topic is exceedingly difficult. With enough time and resources it is possible to obtain very accurate numbers. However, the effort required is prohibitive especially for students. Perhaps this can explain the continuing success of lawyers and accountants who are needed to understand large corporations.

Model estimation

The models were estimated with pooled ordinary least squares estimation. (Wooldridge, 2014)

The models are all first-difference models so any omitted time-invariant corporation-specific effects are removed by the estimator.

The models developed in the literature review are assumed to be the true models because they are derived from economic theory. Omitted variables may bias the estimates but since there is no generally accepted theoretical basis to include more variables, the omitted variable bias is assumed to be inconsequential.

Nonetheless, the estimator is only consistent if there is no autocorrelation in the residuals. To verify the consistency of the estimator, a Durbin-Watson test was performed for each model. The Durbin-Watson test is a test of first-order autocorrelation. (Durbin & Watson, 1971)

Furthermore, heteroskedasticity may lead to misleading standard error estimates. To avoid this problem, heteroskedasticity-robust standard errors were used. Because the sample is a panel, the Arellano heteroskedasticity-robust standard errors were used. (Arellano, 1987)

The full combined sample was used for the estimation. However, to calculate first differences, one observation was removed for each corporation. The sample size used for estimation was therefore (24+25)*(4-1)=147.

This is a relatively small sample compared to earlier research. Ideally, the sample would include more years, more corporations and more countries.

The models were estimated using Gretl.

Hypothesis testing

The implications of each capital structure theory were evaluated using one-tailed and two-tailed T-tests. (Wooldridge, 2014) T-tests are statistical hypothesis tests whose test statistics follow a Student T-distribution under the null hypothesis.

The test statistic of a T-test is calculated using the following formula.

$T = \frac{\hat{\beta} - \beta}{s.e.(\hat{\beta})}$ where $\hat{\beta}$ = Estimated coefficient , β = Null hypothesis and $s.e.(\hat{\beta})$ = Standard error

The null hypothesis is the hypothesised value of the coefficient. It can be obtained from economic theory, previous evidence, etc.

One useful case is when the null hypothesis is equal to zero. This test can be used to determine whether to include an independent variable in a model.

The T-test assumes that the test statistic is a random variable distributed according to a T distribution with $Sample\ size - Explanatory\ variable\ excluding\ constant - 1$ degrees of freedom and a confidence level.

The T distribution is used to calculate the critical value of the T test using the degrees of freedom and the confidence level.

T^* = Critical value

In the case of the two-tailed test, the critical value is compared with the absolute test statistic.

$T^* < |T|$ → Reject null hypothesis

$T^* > |T|$ → Do not reject null hypothesis

The two-tailed test is used to determine whether the coefficient is far from the null hypothesis.

In the case of the one-tailed test, the critical value is compared with the test statistic. The sign of the test statistic matters in this test. If the estimated coefficient is greater than the null hypothesis, then the sign is positive. If the estimated coefficient is less than then null hypothesis, then the sign is negative.

To perform a one-tailed test, it is necessary to have an expectation about the sign of the coefficient.

If the coefficient is expected to be positive, then the following rule is used.

$T^* < T \rightarrow$ Reject null hypothesis

$T^* > T \rightarrow$ Do not reject null hypothesis

If the coefficient is expected to be negative, then the following rule is used.

$-T^* > T \rightarrow$ Reject null hypothesis

$-T^* < T \rightarrow$ Do not reject null hypothesis

The one-tailed test is used to test whether the coefficient is less than or greater than the null hypothesis.

Most statistical softwares output the P-value of T tests. The P-value is the area under the T distribution which is more extreme than the test statistic. In the case of the two-tailed test it includes the area above/below the test statistic and below/above the test statistic after inverting its sign if the test statistic is positive/negative. In the case of the one-tailed test it includes only the area above/below the test statistic if the test statistic is positive/negative.

Because the T distribution is symmetrical around 0, the P-value of a one-tailed test is the P-value of a two-tailed test divided by 2 if the sign is correct and 1 minus the P-value of a two-tailed test divided by 2 if the sign is incorrect.

A low P-value means that the null hypothesis is unlikely to hold while a high P-value means that the null hypothesis is likely to hold.

If the estimated models are the best linear unbiased estimators, then T-tests can be used to reject capital structure theories. (Wooldridge, 2014)

The hypothesis tests were carried out with Gretl.

Empirical evidence

Descriptive statistics

Before estimating any regressions, the capital structures of the corporations in the sample were analysed using descriptive statistics from the US sample and the UK sample.

	Equity		Debt		Debt-to-Equity	
	US	UK	US	UK	US	UK
Minimum	16,929	4,497	3,935	3,235	0.023	0.268
Maximum	428,563	197,871	351,858	126,082	4.497	7.098
Mean	121,656	41,022	113,948	33,509	1.132	1.111
Median	82,470	23,780	77,624	18,195	0.863	0.864
Std. Dev.	86,803	41,662	102,431	29,715	0.912	0.935
Skewness	1.149	2.043	1.038	1.450	1.183	3.652
Kurtosis	0.921	4.786	-0.226	1.309	1.010	18.839

Table 13 : Descriptive statistics of country samples (Own calculation)

US corporations tend to be larger than UK corporations in terms of the book value of equity and the book value of debt. This is expected because the US is a much larger economy. However, the mean and median debt-to-equity ratios are very similar in both countries.

The full descriptive statistics were obtained by combining the two samples.

	Equity	Debt	Debt-to-Equity
Minimum	4,497	3,235	0.023
Maximum	428,563	351,858	7.098
Mean	80,516	72,907	1.121
Median	59,796	39,205	0.863
Std. Dev.	78,645	84,765	0.921
Skewness	1.627	1.874	2.471
Kurtosis	2.647	2.726	10.216

Table 14 : Descriptive statistics of combined sample (Own calculation)

After combining both samples, it seems that the UK has a lower-than-average debt-to-equity ratio while the US has a higher-than-average debt-to-equity ratio. This suggests that legal domicile choice may have a small effect on capital structure decisions.

Modigliani-Miller theorem

The following model was estimated to evaluate the Modigliani-Miller theorem. The dependent

variable is the first difference of the debt-to-equity ratio $\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}}$. A total of 147 observations were used to estimate the model.

	coefficient	std. error	t-ratio	P-value
$Constant$	0.00294640	0.0533080	0.05527	0.9562
$1 - \frac{D_{t-1,i}}{E_{t-1,i}}$	0.329504	0.0371912	8.860	1.14e-011 ***
$US_{t,i}$	0.0243344	0.0588297	0.4136	0.6810
$\left(1 - \frac{D_{t-1,i}}{E_{t-1,i}}\right) US_{t,i}$	−0.235428	0.100101	−2.352	0.0228 **

Mean dependent var	−0.012523	S.D. dependent var	0.597395
Sum squared resid	43.04112	S.E. of regression	0.548623
R-squared	0.173948	Adjusted R-squared	0.156619
F(3, 48)	31.12919	P-value (F)	2.53e-11
Log-likelihood	−118.3056	Akaike criterion	244.6113
Schwarz criterion	256.5730	Hannan-Quinn	249.4715
rho	−0.137683	Durbin-Watson	1.513111

The model explains 17% of the variance in the dependent variable and the model is jointly significant at the 1%, 5% and 10% confidence levels.

However, the Durbin-Watson test statistic 1.513111 is within the positive autocorrelation range of the Durbin-Watson test given the critical values dL=1.689 and dU=1.7722 from the regression of 1+3 independent variables on a sample of 147 observations. The autocorrelation can bias the estimates of the standard errors and result in misleading test results.

Adding one lag of the independent variable to the model results in the test statistic 1.668809 which is within the lower inconclusive range of the test given critical values dL= 1.5872 and dU=1.7567 from the regression of 1+4 independent variables on a sample of only 98 observations because a time period is dropped because of the lagged dependent variable.

	coefficient	std. error	t-ratio	P-value
$Constant$	0.0204550	0.0606163	0.3375	0.7372

$1 - \frac{D_{t-1,i}}{E_{t-1,i}}$	0.354986	0.0539306	6.582	3.22e-08 ***
$US_{t,i}$	−0.0146456	0.0646038	−0.2267	0.8216
$\left(1 - \frac{D_{t-1,i}}{E_{t-1,i}}\right) US_{t,i}$	−0.334892	0.0599919	−5.582	1.08e-06 ***
$\frac{D_{t-1,i}}{E_{t-1,i}} - \frac{D_{t-2,i}}{E_{t-2,i}}$	−0.156668	0.150186	−1.043	0.3021

Mean dependent var	−0.005329	S.D. dependent var	0.652588
Sum squared resid	30.94801	S.E. of regression	0.576866
R-squared	0.250825	Adjusted R-squared	0.218603
F(4, 48)	12.58397	P-value (F)	4.45e-07
Log-likelihood	−82.57570	Akaike criterion	175.1514
Schwarz criterion	188.0762	Hannan-Quinn	180.3792
rho	−0.600444	Durbin-Watson	1.668809

The autocorrelation-corrected model is a better fit. The model explains 25% of the variance in the dependent variable and is jointly significant at the 1% confidence level.

The predictions of the Modigliani-Miller theorem are tested using both regressions. The tests are one-tailed T-tests where the null hypothesis is equal to the right-hand side of the inequalities and the P-value s are calculated using only one tail of the T distribution. If the obtained coefficients agree with a hypothesis, then the P-value is the P-value of the two-tailed test divided by 2. Otherwise, the P-value is 1 minus the P-value of the two-tailed test divided by 2.

The coefficients of both regressions agree with both hypotheses in the US and in the UK.

The results from the first regression are presented in the table below.

UK	US
$\beta_1 > 0 \rightarrow$ P-value = 0.570855e-011	$\beta_1 + \beta_3 > 0 \rightarrow$ P-value = 0.1582425
$\beta_1 < 1 \rightarrow$ P-value = 2.599215e-023	$\beta_1 + \beta_3 < 1 \rightarrow$ P-value = 2.902395e-013

Table 15 : Modigliani-Miller theorem hypothesis test (Own calculation)

The Modigliani-Miller theorem seems to hold in the UK but not in the US. The hypothesis $\beta_1 + \beta_3 > 0$ is rejected at the 1%, 5% and 10% confidence levels in the case of the US.

The results from the second regression are presented in the table below.

UK	US
$\beta_1 > 0 \rightarrow$ P-value = 1.607945e-008	$\beta_1 + \beta_3 > 0 \rightarrow$ P-value = 0.2533235
$\beta_1 < 1 \rightarrow$ P-value = 2.63413e-016	$\beta_1 + \beta_3 < 1 \rightarrow$ P-value = 1.011025e-034

Table 16 : Modigliani-Miller theorem hypothesis test (Own calculation)

The second regression is consistent with the first regression. The conclusions of the tests are

unchanged.

Trade-off theory

The following model was estimated to evaluate the trade-off theory. The dependent variable is the first difference of the debt-to-equity ratio $\frac{D_{t,i}}{E_{t,i}} - \frac{D_{t-1,i}}{E_{t-1,i}}$. A total of 147 observations were used to estimate the model.

The optimal debt-to-equity ratio was specified as the group mean over the sample period. This assumption implies that the optimal debt-to-equity ratio was constant for each corporation during the sample period. This seems like a reasonable assumption because the sample only contains observations from 4 consecutive fiscal years and it is likely that the present values of large multinational corporations interest tax shields and financial distress costs do not change much during such a short time period.

	coefficient	**std. error**	**t-ratio**	**P-value**	
$Constant$	−0.0135788	0.0336003	−0.4041	0.6879	
$O_{t,i} - \frac{D_{t-1,i}}{E_{t-1,i}}$	1.43279	0.210730	6.799	1.49e-08	***
$US_{t,i}$	0.0128333	0.0459713	0.2792	0.7813	
$\left(O_{t,i} - \frac{D_{t-1,i}}{E_{t-1,i}}\right) US_{t,i}$	0.0839227	0.0716824	1.171	0.2475	

Mean dependent var	−0.012523	S.D. dependent var	0.597395
Sum squared resid	18.49938	S.E. of regression	0.359675
R-squared	0.644957	Adjusted R-squared	0.637509
F(3, 48)	1794.245	P-value (F)	2.89e-49
Log-likelihood	−56.24086	Akaike criterion	120.4817
Schwarz criterion	132.4435	Hannan-Quinn	125.3419
rho	−0.203893	Durbin-Watson	1.912448

The model explains 64% of the variance in the dependent variable and the model is jointly significant at the 1%, 5% and 10% confidence levels. Furthermore, according to the Durbin-Watson test, the model displays no autocorrelation.

The predictions of the trade-off theory are tested using the regression. The tests are one-tailed T-tests where the null hypothesis is equal to the right-hand side of the inequalities and the P-values are calculated using only one tail of the T distribution. If the obtained coefficients agree with a hypothesis, then the P-value is the P-value of the two-tailed test divided by 2. Otherwise, the P-value is 1 minus the P-value of the two-tailed test divided by 2.

The coefficients of the regression agree with the greater than zero hypotheses but not the less than one hypotheses in the US and in the UK.

The results from the regression are presented in the table below.

UK	US
$\beta_1 > 0 \rightarrow$ P-value = 0.74726e-008	$\beta_1 + \beta_3 > 0 \rightarrow$ P-value = 1.117245e-006
$\beta_1 < 1 \rightarrow$ P-value = 0.988632875	$\beta_1 + \beta_3 < 1 \rightarrow$ P-value = 0.9633182

Table 17 : Trade-off theory hypothesis test (Own calculation)

The trade-off theory does not seem to hold in the UK or in the US. The null hypotheses $\beta_1 = 1$ and $\beta_1 + \beta_3 = 1$ cannot be rejected in favour of the alternative hypotheses $\beta_1 < 1$ and $\beta_1 + \beta_3 < 1$ at the 1%, 5% or 10% confidence levels.

The signs of the coefficients are correct in terms of the trade-off theory. However, there is no evidence that corporations adjust their debt-to-equity ratios towards the optimal debt-to-equity ratio. Instead, the debt-to-equity ratios seem to fluctuate explosively.

The explosive fluctuations can be visualized by simulating the predicted path of the debt-to-equity ratio starting from a situation where the debt-to-equity ratio is equal to the optimal debt-to-equity ratio. Random shocks are not included in the simulation.

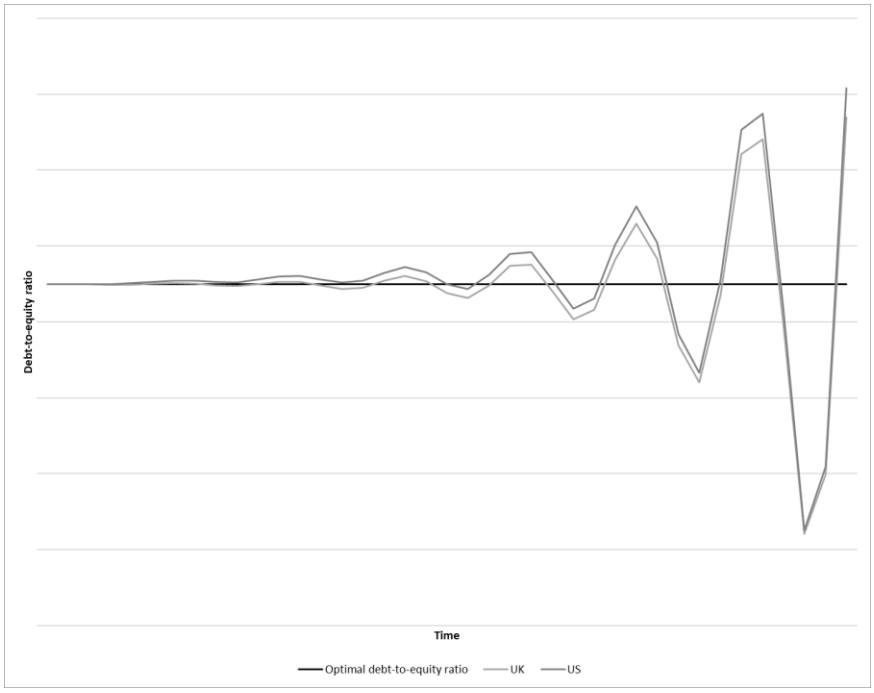

Figure 2 : Simulated explosive fluctuations of the debt-to-equity ratio (Own calculation)

The model suggests that debt-to-equity ratios fluctuate around the optimal debt-to-equity ratio in the US and in the UK. However, the debt-to-equity ratios diverge from the debt-to-equity ratio over time.

The trade-off theory can also be tested using debt instead of the debt-to-equity ratio as the independent variable.

$$D_{t,i} - D_{t-1,i} = \beta_0 + \beta_1\left(O_{t,i}E_{t,i} - D_{t-1,i}\right) + \beta_2 US_{t,i} + \beta_3\left(O_{t,i}E_{t,i} - D_{t-1,i}\right)US_{t,i}$$

The optimal debt-to-equity ratio was again specified as the group mean over the sample period. The optimal debt-to-equity ratio was multiplied by the value of equity to obtain the optimal value of debt.

The model can be interpreted in the same way as the debt-to-equity ratio target-adjustment model.

	coefficient	**std. error**	**t-ratio**	**P-value**	
$Constant$	793.126	725.828	1.093	0.2800	
$O_{t,i}E_{t,i} - D_{t-1,i}$	0.257114	0.0905386	2.840	0.0066	***
$US_{t,i}$	955.353	1290.28	0.7404	0.4626	
$\left(O_{t,i}E_{t,i} - D_{t-1,i}\right)US_{t,i}$	0.478298	0.114033	4.194	0.0001	***

Mean dependent var	3741.583	S.D. dependent var	12942.95
Sum squared resid	1.36e+10	S.E. of regression	9747.630
R-squared	0.444461	Adjusted R-squared	0.432806
F(3, 48)	40.38454	P-value (F)	3.56e-13
Log-likelihood	-1556.719	Akaike criterion	3121.438
Schwarz criterion	3133.399	Hannan-Quinn	3126.298
rho	-0.194870	Durbin-Watson	1.611298

The model explains 44% of the variance in the dependent variable and the model is jointly significant at the 1%, 5% and 10% confidence levels.

However, the Durbin-Watson test statistic 1.611298 is within the positive autocorrelation range of the Durbin-Watson test given the critical values dL=1.689 and dU=1.7722 from the regression of 1+3 independent variables on a sample of 147 observations. The autocorrelation can bias the estimates of the standard errors and result in misleading test results.

Unfortunately, the positive autocorrelation remains even after including a lagged dependent variable and time dummies. Furthermore, adding the second lag of the dependent variable turns the model into a cross-sectional model with only one time period.

Nonetheless, the model is used because the Durbin-Watson test statistic is relatively close to being in the inconclusive range of the Durbin-Watson test. Caution must therefore be used in the hypothesis tests since the standard errors are likely under-estimates implying that the T-statistics are over-estimates.

The predictions of the trade-off theory are tested using the regression. The tests are one-tailed T-tests where the null hypothesis is equal to the right-hand side of the inequalities and the P-value s are calculated using only one tail of the T distribution. If the obtained coefficients agree with a hypothesis, then the P-value is the P-value of the two-tailed test divided by 2. Otherwise, the P-value is 1 minus the P-value of the two-tailed test divided by 2.

The coefficients of the regression agree with the greater than zero and less than one hypotheses for the UK and the US.

The results from the regression are presented in the table below.

UK	US
$\beta_1 > 0 \rightarrow$ P-value = 0.003300715	$\beta_1 + \beta_3 > 0 \rightarrow$ P-value = 1.771545e-014
$\beta_1 < 1 \rightarrow$ P-value = 0.54015e-010	$\beta_1 + \beta_3 < 1 \rightarrow$ P-value = 0.000193727

Table 18 : Trade-off theory hypothesis test (Own calculation)

The trade-off theory seems to hold in the UK and in the US. All the null hypotheses are rejected in favour of the trade-off theory hypotheses at the 1% confidence level.

However, the low P-value s may be misleading. However, because the P-value s are so low and the Durbin-Watson test statistic is close to the inconclusive range, it is likely that the bias due to positive autocorrelation does not change the conclusions of the tests at the 1%, 5% and 10% confidence levels.

Pecking order theory

The following model was estimated to evaluate the pecking order theory. The dependent variable is the first difference of the value of debt $D_{t,i} - D_{t-1,i}$. A total of 147 observations were used to estimate the model.

	coefficient	**std. error**	**t-ratio**	**P-value**	
$Constant$	2580.92	1076.39	2.398	0.0204	**
$DEF_{t,i}$	0.150110	0.0891661	1.683	0.0988	*
$US_{t,i}$	3368.81	2000.03	1.684	0.0986	*
$DEF_{t,i}US_{t,i}$	−0.00605261	0.123491	−0.04901	0.9611	

Mean dependent var	3741.583	S.D. dependent var	12942.95
Sum squared resid	2.21e+10	S.E. of regression	12445.65
R-squared	0.094368	Adjusted R-squared	0.075369

F(3, 48)	3.371914	P-value (F)	0.025878
Log-likelihood	−1592.638	Akaike criterion	3193.276
Schwarz criterion	3205.237	Hannan-Quinn	3198.136
rho	−0.268237	Durbin-Watson	1.586996

The model explains 9% of the variance in the dependent variable and the model is jointly significant at the 5% and 10% confidence levels.

However, the Durbin-Watson test statistic 1.586996 is within the positive autocorrelation range of the Durbin-Watson test given the critical values dL=1.689 and dU=1.7722 from the regression of 1+3 independent variables on a sample of 147 observations. The autocorrelation can bias the estimates of the standard errors and result in misleading test results.

Unfortunately, the positive autocorrelation remains even after including a lagged dependent variable and time dummies. Furthermore, adding the second lag of the dependent variable changes the model into a cross-sectional model with only one time period.

Nonetheless, the model is used because the Durbin-Watson test statistic is relatively close to being in the inconclusive range of the Durbin-Watson test. Caution must therefore be used in the hypothesis tests since the standard errors are likely under-estimates implying that the T-statistics are over-estimates.

The predictions of the trade-off theory are tested using the regression. The tests are two-tailed T-tests where the null hypothesis is equal to the right-hand side of the equalities and the P-value s are calculated using both tails of the T-distribution.

The results from the regression are presented in the table below.

UK	US
$\beta_0 = 0$ and $\beta_1 = 1$ → P-value = 4.38293e-020	$\beta_0 + \beta_2 = 0$ and $\beta_1 + \beta_3 = 1$ → P-value = 1.18515e-015

Table 19 : Trade-off theory hypothesis test (Own calculation)

The pecking order theory does not seem to hold in the UK or the US. The pecking order theory null hypotheses can be rejected at the 1%, 5% and 10% confidence levels in favour of the alternative hypotheses.

However, the results may not be reliable for two reasons. First, the fund flow deficit may be wrongly calculated during the data collection. Second, positive autocorrelation may lead to over-estimated T-statistics.

The pecking order model was also estimated using the first difference of the value of equity $E_{t,i} - E_{t-1,i}$ as the dependent variable. A total of 147 observations were used to estimate the model.

	coefficient	std. error	t-ratio	P-value

$Constant$	2271.58	1488.79	1.526	0.1336
$DEF_{t,i}$	0.113837	0.127307	0.8942	0.3757
$US_{t,i}$	3064.05	2884.15	1.062	0.2934
$DEF_{t,i}US_{t,i}$	−0.190055	0.145759	−1.304	0.1985

Mean dependent var	3553.772	S.D. dependent var	13198.12
Sum squared resid	2.43e+10	S.E. of regression	13043.53
R-squared	0.043359	Adjusted R-squared	0.023290
F(3, 48)	1.187604	P-value (F)	0.324403
Log-likelihood	−1599.535	Akaike criterion	3207.070
Schwarz criterion	3219.032	Hannan-Quinn	3211.931
rho	0.150002	Durbin-Watson	1.050986

The model explains 4% of the variance in the dependent variable but the model is jointly insignificant at the 1%, 5% and 10% confidence levels.

Furthermore, the Durbin-Watson test statistic 1.050986 is within the positive autocorrelation range of the Durbin-Watson test given the critical values dL=1.689 and dU=1.7722 from the regression of 1+3 independent variables on a sample of 147 observations. The autocorrelation can bias the estimates of the standard errors and result in misleading test results.

The model is a bad fit and does not explain changes in the value of equity.

Nonetheless, the coefficients of this model can be compared with the coefficients of the debt model to determine whether corporations tend to prefer debt or equity issues to finance the fund flow deficit.

All other things being equal, if the deficit increases by 1$ in a UK corporation, then the level of debt increases by 0.15$ and the level of equity increases by 0.11$. The remaining 0.74$ seem to be financed with internal cash reserves or other sources of financing.

All other things being equal, if the deficit increases by 1$ in a US corporation, then the level of debt increases by 0.15-0.01=0.14$ and the level of equity decreases by 0.11-0.19=0.08$. The decrease in the level of equity is unexpected. The remaining 0.94$ seem to be financed with internal cash reserves or other sources of financing.

Analysis

Modigliani-Miller theorem

Findings

The Modigliani-Miller theorem seems to hold in the UK but not in the US.

Debt-to-equity ratios tend to adjust towards 1 in both countries. However, the rate of adjustment is higher in the UK than in the US.

However, autocorrelation presents a problem in terms of model estimation.

Autocorrelation does not contradict the Modigliani-Miller theorem. Random shocks in equity and debt may push the debt-to-equity ratio away from 1 but the effect will eventually fade in terms of the debt-to-equity ratio.

Furthermore, after correcting the model for autocorrelation, the conclusions of the T-tests remain unchanged and the rate of adjustment towards 1 increases for the UK and decreases for the US.

Shocks in the debt-to-equity ratios of US corporations tend to have longer-lasting effects than shocks in the debt-to-equity ratios of UK corporations.

The results suggest that UK corporations may have weaker preferences over equity and debt issuance than US corporations.

US corporations tend to issue either more equity or more debt while UK corporations tend to issue both in more equal quantities.

Discussion

The Modigliani-Miller theorem is a consequence of the perfect capital markets assumptions.

The findings therefore suggest that the perfect capital markets assumptions hold in the UK but not in the US.

The first and third assumptions are difficult to examine empirically so they are not discussed.

The second assumption states that there are no taxes, transaction costs or issuance costs

associated with security trading. This assumption is necessary for the arbitrage argument used to prove the Modigliani-Miller theorem. If investors are discouraged from trading because of costs, then the arbitrage argument may no longer hold.

Previous research on the trading costs of institutional traders has found that explicit trading costs such as broker fees and transaction taxes are actually lower in the US than in the UK but that implicit trading costs defined as the deviation of the price from a theoretical unperturbed price are higher in the US than in the UK. (Domowitz et al., 2001)

The lower explicit trading cost in the US contradicts the findings of this thesis. However, the authors found that on average explicit trading costs represent 0.083% of transaction value in the US and 0.393% of transaction value in the UK. Given that the US stock market outperformed the UK stock market during the sample period, this difference in explicit costs may be negligible.

The higher implicit trading costs, however, confirm the findings of this thesis. The higher implicit trading costs in the US may reflect a higher presence of high-frequency traders in US capital markets compared to UK capital markets. High-frequency traders earn profit because they can access the trade data of stock exchanges faster than other investors. For example, a high-frequency trader may know that an investor wants to buy a security before other investors. Using this information, they may buy the security from elsewhere and sell it to the investor with a small premium. Previous research has found that high-frequency traders represent approximately 70% of all equity trades in the US but only around 30-40% of all equity trades in the EU. (Haldane, 2010) The presence of high-frequency traders increases the implicit cost of trading and therefore discourages investors from taking advantage of arbitrage opportunities.

Trade-off theory

Findings

It is unclear whether the trade-off theory holds in the UK or in the US.

The debt-to-equity ratio model suggests that the trade-off theory holds in neither country.

However, assuming that autocorrelation does not cause significant problems, the debt model suggests that the theory holds in both countries.

US corporations tend to adjust faster towards the optimal debt level than UK corporations. This finding is consistent with the findings with respect to the Modigliani-Miller theorem because the trade-off theory is one explanation for why corporations may prefer equity or debt issuances.

The findings suggest that the effects of the interest tax shield and financial distress costs may be more important in the US than in the UK.

Discussion

The trade-off theory depends on the existence of the interest tax shield and financial distress costs.

The findings therefore suggest that these capital market imperfections exist in the US and the UK but that their effects seem to be more important in the US.

The interest tax shield depends on the corporate tax rate in each country.

Historically, the US corporate tax rate has tended to be higher than the UK tax rate. However, the Tax Cuts and Jobs Act of 2017 cut the US corporate tax rate from 35% to 21% in 2017. Interestingly, the UK corporate tax rate was also cut in 2017 but only slightly from 20% to 19%.

However, the corporate tax rate is not the only determinant of the value of the interest tax shield. Real tax regimes are complex and contain both legal and illegal means to reduce the amount of taxable income. The tax rate which matters for corporations is the effective tax rate defined as the actual taxes paid divided by pre-tax income. Previous research has found that the US effective tax rate tends to be higher than the UK effective tax rate. (PricewaterhouseCoopers, 2011) This research was conducted before the 2017 tax regime changes. However, the authors found that the effective tax rate is positively correlated with the corporate tax rate. Therefore, it is reasonable to assume that the tax regime changes also caused a convergence of the effective tax rates in the US and the UK.

The analysis of tax regimes is not within the scope of this thesis. However, the convergence of the corporate tax rates and the likely convergence of the effective tax rates suggest that the US and the UK are engaged in tax competition. In short, tax competition is like a price war but where the price is the tax rate. (Nieminen et al., 2019)

In terms of the trade-off theory, the substantial change in the US corporate tax regime reduced the values of interest tax shields since less tax can now be offset with interest expenses. All other things being equal, the trade-off theory predicts a decrease in the debt-to-equity ratio in the US. The same reasoning applies to the UK, but the effect may have been negligible.

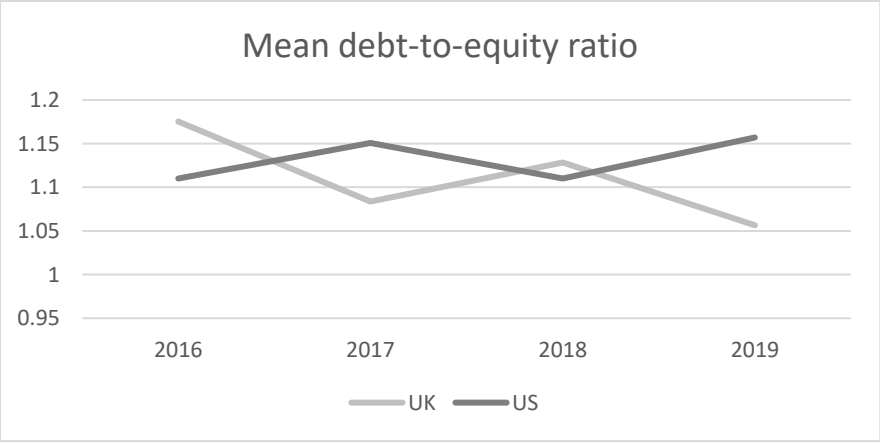

Figure 3 : Changes in the mean debt-to-equity ratio in the UK and the US (Own calculation)

As seen in the figure above, the mean debt-to-equity ratio decreased in the US in 2018 as predicted by the trade-off theory. In contrast, the mean debt-to-equity ratio actually increased in

the UK which suggests that the change in the tax regime was negligible. However, by 2019, the US mean debt-to-equity ratio had increased and the UK mean debt-to-equity ratio had decreased. This does not necessarily contradict the trade-off theory since the optimal debt-to-equity ratio may have changed again in 2019 due to other factors.

Financial distress costs depend on many factors which do not necessarily depend on the choice of legal domicile.

However, previous research in the has identified important differences between US and UK bankruptcy laws. (Franks et al., 1996) In the US, the Chapter 11 bankruptcy protection legislation allows even solvent corporations to suspend interest and principal payments for 120 days whilst shareholders have an exclusive right to propose a reorganization. The protection works because managers know more about the default risk than do the creditors so they can apply for bankruptcy protection before a default occurs. In the UK, there is no equivalent bankruptcy protection law. Put simply, the US system favours shareholders while the UK system favours creditors. The research found that US bankruptcies tend to be concluded slower and cost more in terms of direct costs such as fees paid to outside experts while UK bankruptcies tend to be concluded faster but cost more in terms of indirect costs such as fire sales of assets. Therefore, while there are differences between bankruptcy laws between the US and the UK, it is not clear whether the differences influence financial distress costs.

Within the US, previous research has found that choosing Delaware as the legal domicile can increase the value of a corporation after controlling for various factors which also influence value. (Daines, 2001) The reason for this effect is that Delaware has specialized in being the legal domicile of US corporations. In fact, over 50% of publicly traded US corporations are based in Delaware. The state has a specialized court for business disputes. The judges of the court have expertise in complex business cases. No other US state has such a court. Instead, other states allocate cases to normal courts and judges who may not have the same expertise. In other words, an ecosystem of corporations and legal services has developed in Delaware. Because of this, it is likely that the direct financial distress costs of a corporation legally domiciled in Delaware are lower than the direct financial distress costs of an identical corporation based in another US state. Furthermore, Delaware laws are less restrictive to takeovers compared to other US states. Delaware corporations are more likely to receive takeover bids compared to corporations in other US states. This is further evidence of a business ecosystem that has developed in Delaware. Consequently, a corporation legally domiciled in Delaware may face lower indirect financial distress costs compared to an identical corporation legally domiciled in another US state because they can liquidate assets more easily.

In the UK, a similar ecosystem has developed in London. (Kuah, 2008) The city is known for finance but also contains an ecosystem of legal services and other business services which help corporations reduce direct and indirect financial distress costs.

There seems to be little evidence of significant differences between the US and the UK in terms of financial distress costs.

Pecking order theory

Findings

The pecking order theory does not seem to hold in either country. However, the results are not robust.

UK corporations tend to only finance 15% of the fund flow deficit with debt while US corporations tend to finance 14% of the fund flow deficit with debt. In contrast, UK corporations tend to finance 11% of the fund flow deficit with equity while US corporations tend to finance -8% of the fund flow deficit with equity.

The low proportion of the fund flow deficit financed by debt and equity probably reflects the large cash balances of US and UK corporations. As predicted by the pecking order theory, many corporations in the sample have large cash reserves which they can use to finance the fund flow deficit.

The negative proportion of the fund flow deficit financed by equity in the US may reflect the fact that most of the US corporations in the sample are profitable so they have a fund flow surplus or a negative fund flow deficit. If corporations retain the surplus in cash or in other assets, then the value of equity increases which results in a negative coefficient in the regression. However, it is more likely that the result is due to a bad specification of the fund flow deficit.

Discussion

The pecking order theory is founded on the information asymmetry between managers and investors.

The findings provide tentative evidence of similarities in information asymmetry and management practices in the US and the UK.

Information asymmetry depends on corporate disclosure requirements and practices.

Previous research has found that US corporations have tended to disclose information more frequently than UK corporations. (Frost & Pownall, 1994) US disclosure tended to be a legal requirement while UK disclosure tended to be voluntary. However, more recent research has found a positive trend in the amount of information disclosed by UK corporations. (Rajab & Handley-Schachler, 2009)

The convergence in disclosure seems to confirm the findings. A similar level of disclosure should result in a similar information asymmetry and therefore similar funding decisions.

However, it is unclear whether increased disclosure removes the asymmetric information. On one hand, investors know more so some part of the asymmetry is reduced. However, on the other hand, corporations have become more complex over time so new asymmetries may exist.

Management practices depend on the collective decisions of shareholders.

UK and US capital markets are highly integrated. Capital can move freely between the US and the UK. In other words, US investors can invest in the UK and UK investors can invest in the US. Therefore, broadly speaking, the same set of investors controls both US and UK corporations so it is likely that management practices are also similar in both countries.

Conclusion

The thesis considered three models of capital structure decisions.

The Modigliani-Miller theorem was found to be a good predictor of capital structure decisions in the UK but not in the US.

The trade-off theory seemed to be the best model of capital structure decisions both in the US and the UK. The estimates suggest that the theory is followed more closely in the US than in the UK which is consistent with the findings with respect to the Modigliani-Miller theorem.

It is unclear whether the pecking order theory applies to the US or the UK even though tentative evidence was found in favour of the theory in both jurisdictions.

The analysis found two differences between the US and the UK which are likely to influence capital structure decisions.

First, the larger presence of high frequency traders in the US compared to the UK seems to prevent investors in the US from taking advantage of the Modigliani-Miller arbitrage opportunities. Consequently, US corporations tend to issue either more debt or more equity while UK corporations tend to issue both in more equal proportions.

Second, differences between US and UK tax regimes seem significant in terms of capital structure decisions. Furthermore, differences in the differences between US and UK tax regimes seem to push US corporations and to a lesser extent UK corporations to change their capital structures towards the optimal capital structure as predicted by the trade-off theory.

This research can be improved by analysing a larger and more robust dataset. Furthermore, other capital structure theories should be considered and different interpretations of the included capital structure theories should be tested. Finally, alternative analyses of differences between jurisdictions should be developed.

Bibliography

Akerlof, G. A. (1978). The market for “lemons”: Quality uncertainty and the market mechanism. In Uncertainty in economics (pp. 235-251). Academic Press.

Arellano, M. (1987). Computing robust standard errors for within-groups estimators. Oxford bulletin of Economics and Statistics, 49(4), 431-434.

Brealey, R., Myers, S., & Allen, F. (2016). Principles of corporate finance (12th ed.). McGraw-Hill/Irwin.

Collins, A. (1978). Choice of Corporate Domicile: California or Delaware. SFL Rev., 13(1), 103-144.

Daines, R. (2001). Does Delaware law improve firm value?. Journal of Financial Economics, 62(3), 525-558.

Domowitz, I., Glen, J., & Madhavan, A. (2001). Liquidity, Volatility and Equity Trading Costs Across Countries and Over Time. International Finance, 4(2), 221-255.

Donaldson, G. (1961). Corporate Debt Capacity. A study of corporate debt policy and the determination of corporate debt capacity. Harvard University.

Durbin, J., & Watson, G. S. (1971). Testing for serial correlation in least squares regression. III. Biometrika, 58(1), 1-19.

Franks, J., Nyborg, K., & Torous, W. (1996). A Comparison of US, UK, and German Insolvency Codes. Financial Management, 25(3), 86.

Frost, C. A., & Pownall, G. (1994). Accounting disclosure practices in the United States and the United Kingdom. Journal of Accounting Research, 32(1), 75-102.

Haldane, A. (2010). Patience and finance [Speech]. Oxford China Business Forum, Beijing.

Hodder, L. D., Hopkins, P. E., & Schipper, K. (2014). Fair value measurement in financial reporting. Foundations and Trends in Accounting, 9.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. The journal of finance, 28(4), 911-922.

Kuah, A. T. (2008). Is there a diamond in the city? Leveraging the competitive advantage of the London financial centre. Singapore Management Review, 30(2), 1-17.

Lee, C. (2000). The Silicon Valley edge. Stanford University Press.

Maru File, K., Cermak, D., & Alan Prince, R. (1994). Word-of-Mouth Effects in Professional Services Buyer Behaviour. The Service Industries Journal, 14(3), 301-314.

Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. The American economic review, 48(3), 261-297.

Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital: a correction. The American economic review, 53(3), 433-443.

Myers, S. (1984). The Capital Structure Puzzle. The Journal Of Finance, 39(3), 575.

Myers, S., & Majluf, N. (1984). Corporate financing and investment decisions when corporations have information that investors do not have. Journal Of Financial Economics, 13(2), 187-221.

Nieminen, E. Culot, M., Dupont, L., Piccoli, A., Rodriguez, M. (2019). Tax system and incorporation [Unpublished presentation, Public finance coursework], HEC Liège.

PricewaterhouseCoopers. (2011). Global effective tax rates. Retrieved 19 August 2020, from https://s3.amazonaws.com/brt.org/archive/Effective_Tax_Rate_Study.pdf.

Rajab, B., & Handley-Schachler, M. (2009). Corporate risk disclosure by UK firms: trends and determinants. World Review of Entrepreneurship, Management and Sustainable Development, 5(3), 224-243.

Saxenian, A. (1983). The Genesis of Silicon Valley. Built Environment (1978-), 7-17.

Shyam-Sunder, L., & Myers, S. C. (1999). Testing static tradeoff against pecking order models of capital structure. Journal of financial economics, 51(2), 219-244.

Wooldridge, J. (2014). Introduction to econometrics. Cengage Learning.