



BI Norwegian Business School - campus Oslo

# GRA 19502

Master Thesis

Component of continuous assessment: Forprosjekt, Thesis  
MSc

DO FINANCIAL BENEFITS EXPLAIN CORPORATE SPIN-OFFS?

Start: 01.12.2016 09.00

Finish: 16.01.2017 12.00

**DO FINANCIAL BENEFITS  
EXPLAIN CORPORATE  
SPIN-OFFS?**

*Lars Andreas Haugen  
Damiano Maggi*

*Supervisor: Professor Johann Reindl, PhD*

**Master of Science in Business  
Master of Science in Financial Economics**  
BI - Norwegian Business School  
Class: 2015-17

# Abstract

In our thesis we want to investigate whether *financial synergies* can be considered as a driver of corporate spin-offs. The majority of the studies have been focused on different synergies and/or drivers. We will use our sample of spin-offs and we will test our hypothesis. We aim to make a contribution to the knowledge developed so far in the finance field.

*Non scholae, sed vitae discimus.*

*Seneca*

# Contents

<b>Abstract</b>	<b>2</b>
<b>1 Introduction</b>	<b>5</b>
1.1 Our research question . . . . .	5
1.2 An interesting topic to study . . . . .	5
1.3 Capital Structure: Insights . . . . .	6
<b>2 Background and Literature</b>	<b>7</b>
2.1 What is a Spin-off? . . . . .	7
2.2 Previous Work on Corporate Spin-Offs . . . . .	7
2.2.1 Spin-Offs in the literature: main drivers . . . . .	7
2.2.2 Financial Benefits as a driver of Spin-Offs . . . . .	9
2.3 Our Study . . . . .	10
<b>3 Theory</b>	<b>11</b>
3.1 Synergies: Basic foundation . . . . .	11
3.2 The Optimal Capital Structure . . . . .	12
3.2.1 Modigliani and Miller 1958 . . . . .	12
3.2.2 Leland 2007 . . . . .	13
3.2.3 Optimal Capital Structure according to Leland(2007) . . . . .	15
3.2.4 Gains from leverage . . . . .	16
3.3 Estimating Financial Synergies for firms . . . . .	16
3.3.1 Financial Synergies . . . . .	16
3.3.2 The three main components of Financial Synergies . . . . .	17
3.4 Problems with Leland(2007) capital structure estimation . . . . .	17
3.5 Testable Hypothesis . . . . .	18
<b>4 Empirical Design of the study</b>	<b>19</b>
4.1 Methodology . . . . .	19
4.2 Statistical tools . . . . .	19
<b>5 Sample selection</b>	<b>20</b>
5.1 Data . . . . .	20

**A Bibliography**

**21**

# Chapter 1

## Introduction

### 1.1 Our research question

The optimal capital structure is among the most important decisions of management and also frequently studied by academics. What determines the capital structure and what is the motivation for mergers and spinoffs? In a Modigliani-Miller (1958) world there is no financial synergies and therefore the capital structure is irrelevant. In this theoretical setting we leave out taxes, bankruptcy costs, informational asymmetries and agency cost. However, when we include bankruptcy costs and taxes, the capital structure matters and optimal capital structure can create financial synergies. In this paper we want to examine if purely financial synergies explain spinoffs as a tool to optimize the capital structure and alter the scope of the company. Our research question in our thesis is Can financial synergies explain the motivation for corporate spinoff?

### 1.2 An interesting topic to study

Positive (that argues for merger) or negative (that argues for spinoff) synergies are linked to the decisions that could alter the scope of the firm is often operational. Previous research addresses the importance of economies of scale, economies of scope and the market power. Operational synergies are, therefore, often an argument for M&A when changing the scope of the firm. On the other hand, operational synergies have difficulty explaining the motivation for asset spinoffs, asset securitization and structured finance. Leland (2007) concludes that financial benefits explains in a larger extent spinoffs and structured finance than mergers. This paper has the purpose of finding the motivation behind spinoffs and quantify the effects on the scope of the firm when using such strategy. Sarig (1975) illustrates the loss of the double protection for corporate security holders for merged firms with a single period economy. Sarig concludes that similar analysis suggest that divesting economically unrelated lines of business should increase the aggregate value of the corporate securities. Another theoretical study by Scott (1977) present a two period state preference model where

conglomerate merged firms A and B is compared with non-merged A and B firm to check for financial synergies. The study on merged firms emphasize that the conclusions also holds for conglomerate divestitures. Scott(1977) concludes that for firms with both debt and equity outstanding, the tax structure encourages mergers, while bankruptcy costs and non-contractual obligations can work in either direction. Our motivation for the thesis is to find empirical evidence and quantify financial synergies from divestitures. Separate entities allow firms to optimize the capital structure with the appropriate amount of debt and equity. This can be done by a special purpose entity (SPE) or separate corporation. The new entity may allow for greater leverage then then a merged firm with single capital structure if the activities differ in a large extent with respect to business risk or bankruptcy costs.

### 1.3 Capital Structure: Insights

The firms optimal capital structure is linked to their business risk. The trade-off theory (Kraus 1973) show a close link between capital structure and business risk. Capital structure can easily be extracted from the financial statement and be analyzed. On the other hand, business risk is more complicated to quantify. Previous research related to business risk as a quantitatively effect on capital structure uses either cash flow volatility or asset volatility to measure business risk and focus on merger. Our ambition is to give a contribution to the literature regarding financial synergies and the optimal scope of the firm. Moreover, we want to examine if the asset volatility could also explain the motivation for firms to use spinoffs.

**Structure of this paper** The rest of this paper is organized as follow: (i) Chapter II will present you a wide background on corporate spin-offs and the empirical work done so far; (ii) Chapter III will introduce the main theory of capital structure and (iii) Chapter IV will illustrate our process of data selection.

## Chapter 2

# Background and Literature

### 2.1 What is a Spin-off?

A spin-off is a type of corporate divestiture. It is among the most important decisions faced by the management of a firm. A first, and simple, definition of a spinoff is:

*A corporate spin-off is the division of a business unit from its parent company.*

It can further express as the following:

*A spin-off happens when a company decide to distribute all the equity of a subsidiary, forming a separate firm, to its existing shareholder.*

The spin-off belongs to the group of a broader category of corporate decision: *Corporate Divestiture*. A corporate divestiture is when a firm dispose of its asset and remove them from the rest of the firm. This group enlarges different types of strategies such as: (i) Sell-off; (ii) Spin-Off; (iii) Equity Carve-Out. It is worthwhile to point out why spin-offs are slightly different to the other two types of corporate divestiture. While *Sell-Off* and *Equity Carve-Out* generates wealth to the parent firm, *Spin-Off* does not. The reason is that the shares steaming from the spin-offs are given to the existing shareholders, while the parent firm, usually, does not retain shares in the subsidiary. Finally, as almost every business decision, a spin-off involves a trade-off between positive and negative consequences which the managers need to carefully ponder.

### 2.2 Previous Work on Corporate Spin-Offs

#### 2.2.1 Spin-Offs in the literature: main drivers

Spin-offs, as noted in the previous section, have a considerable impact in the business world. Yet, lots of papers have been focused on the opposite activity (Mergers and Acquisition). The majority of the studies have focused on different drivers to explain spin-offs. In this thesis we want to present the reader an extensive background on these drivers and introduce



our study of financial benefits as a driver for this type of corporate divestiture.

Empirically, these groups have been treated as the main drivers of spin-offs:

- Corporate Focus;
- Wealth transfer from bondholders;
- Reduction of negative synergies;
- Information asymmetries;
- Clientele effects;
- Increased probability of a takeover;

**Corporate Focus** *Spin-Offs can create value due to an increased corporate focus after the corporate divestiture of unrelated divisions.* Daley, Mehrotra, and Sivakumar(1997) reports positive return when the parent company and the spun-off company have different two-digit SIC industry codes (signaling a higher corporate focus). They found a substantial improvements for the parents (increased Return On Assets) when the spin-off was driven by focus-increasing. Desai and Jain(1999) found that these corporate focus driven spin-offs are associated with, among others, higher announcement-day returns and improved operating performance. Berger and Ofek(1999) in their paper analysed the possible causes of corporate refocusing program. They have three possible explanation to this phenomenon. First, as observed by Subrahmanyam and Titman(1999) too, is the decrease in the benefits of having an internal capital markets [see also Ahn and Denis(2004)]. A second explanation involves the change in competitive and regulatory conditions during the 1980s. A third, and final explanation, involves the agency conflicts between managers and owners. Berger and Ofek(1999) found that the average CARs related to refocusing announcements was around 7.3 percentage and were associated with the new diversification policy of the refocuser.

**Wealth transfer from bondholders** *Spin-offs increase shareholders' wealth while reducing firm's debt-holders by reducing the total asset of the firm.* Galai and Masulis(1976) studied whether an increase in cash flows' volatility leads to a reduced payoff for the debtholders. They found out that their hypothesis confirmed by empirical results and they observed that the decrease in the debtholders expected payoff is accrued to shareholders. Furthermore, MacMinn and Brockett(1995) argued that spin-offs transfer the firm's assets away from the debtholders, reducing, as a result, the debtholders expected payoff.

**Reduction of negative synergies** *Separating two different divisions may create value through the reduction of any existing negative synergies between the parent company and its subsidiary.* Gertner, Power, and Scharstein(2002) found that subsidiary's investment decisions become more sensitive after the spin-off has taken place. Seoungpil and Denis(2004)

documented that, before the spin-off takes place, parent firm invest less in high-growth division and are traded at discount compared to peers. After the spin-off is executed, the parent firms' diversification discount is eliminated and investments for the high-growth division has increased.

**Information asymmetries** *Having too many divisions under the same parents can create information asymmetries between outside investors and inside investors.* This is due to the aggregation of financial data across divisions. Among the scholars who researched information asymmetries as a driver for corporate divestiture, Krishnaswami and Subramaniam(1999) found that spin-offs are more common for firms with a higher degree of information asymmetries between the two groups of investors. This suggest that an increase in value for the parent firm and the subsidiary firm is due to the mitigation of these information asymmetries.

**Clientele Effects** *The spin-off creates the possibility to hold the subsidiary stock separately from the rest of the firm.* Vjih(1994) analyzing a sample of 113 spinoffs (from 1964 to 1990) found that there is an average excess return of 3.0 percentage (on ex-date) associated with the spin-off. Vjih's argument is that this return is because the two different stocks (parent stocks and spun-off stocks) attract different type of investors.

**Increase probability of a takeover** *The spin-off creates the possibility that the division will be the target of a takeover.* Cusatis, Miles, and Woolridge(1993) examined 146 tax-free spinoffs (period 1965-1988). They found that both the parent and the spun-off division are more likely to become a target for takeovers compared to similar firms.

After assessing the fact that corporate divestiture increase the value of both the parent firm and the new subsidiary, many scholars have tried to quantify the increase in wealth steaming from corporate divestiture. Before Vjih's (1994) article, Hite and Owers (1983) found that there is a 3.30 percent excess-return over the event period and 7.0 percentage excess-return over an extended-period (starting 50 days before the first announcement to the actual spin-off). Schipper and Smith (1983) report a 2 days excess-return of 2.84 percentage. Miles and Rosenfeld(1983) found a 3.4 percentage return associated with a corporate spin-off.

## 2.2.2 Financial Benefits as a driver of Spin-Offs

It can observed that spinoffs are not based only on managerial impulse and decisions, but rather that these kind of actions brings a positive result for both.

Leland(2007) tried to theorize why there has been a massive use of *structured finance* (i.e. securitization, project financing, etc.) and *spin-offs* in the past decades. Leland's argument

is that separating financial operations will allow each part to have separate optimal capital structure and separated limited liabilities. As a result, these two effects together might allow for greater leverage than the leverage of the two firms when are combined into a single entity. Hence, we can express this relationship as:

$$LV(A) + LV(B) > LV(AB)$$

Where  $LV(A)$  is the leverage level of entity A,  $LV(B)$  is the leverage level of entity B, and  $LV(AB)$  is the leverage level of the two entities together. Leland's argument

As discussed in the previous section, the majority of the empirical work relating to financial benefits has been focused on activities of Mergers & Acquisitions. Levine and Wu(2016) found that one standard deviation decline in asset volatility of the merged firm (i.e. conglomerate firm) leads to approximately a 10.3 percentage point increase in leverage. Lewellen(1971) assume that there are *positive* financial benefits when two firms merge together.

## 2.3 Our Study

Our research is mainly based understanding whether the negative financial synergies can be a driver for corporate spin-offs. We will base our study on relevant theories of financial synergies, optimal corporate capital structure and more in general all the resources we need to use in order to extract meaningful conclusion. Therefore, we will, using the framework developed in the theory chapter, estimate financial synergies as a first step. Afterward, we will estimate, for each firm, the ex-ante capital structure and the ex-post capital structure. As a result, we will be able to test the two main hypothesis of our study, developed in the last section of chapter III. We aim, with this study, to make a contribution in the finance field. More specifically, we aim to provide a better understanding of corporate spin-offs, which is a not deeply researched topic as M&A.

# Chapter 3

## Theory

### 3.1 Synergies: Basic foundation

In the previous chapter it has been discussed the basic definition of spin-off, the empirical background related to the main drivers of spin-offs and the previous work on financial benefits as main driver. Let us define what a synergy is:

A synergy is the increase in value created by the combined operations of two different firms (i.e. Firm A and Firm B).

We can express this concept in the following formula:

$$V(AB) > V(A) + V(B)$$

Where  $V(AB)$  is equal to the value of the two firms combined together,  $V(A)$  stands for the value of firm A alone, and  $V(B)$  is the value of firm B alone.

As a result the *synergies* between two firms can be expressed as the following:

$$S = V(AB) - [V(A) + V(B)]$$

One of the main justification for M&A and corporate spin-offs are *operational synergies*. *Operational synergies* occurs when the *operations* of two different firms together are more efficient than the sum of the separate operations of the firms. These synergies can be either *positive*, which will induce merger among firms, or *negative* which causes the division of the two entities. *Operational synergies* can have different causes as:

- Economies of Scale
- Economies of Scope
- Market Power

Each of this and other factors affect the optimal boundaries of the firm, which as a result, will influence the extent of *operational synergies* between two entities.

While *operational synergies* are assumed to be the main driver for the activity of M&A and Spin-offs, we have lacked to identify another type of synergies, namely *financial synergies*.

*Financial Synergies* are those synergies that steam from purely financial considerations such as:

- Reduction in cost of capital;
- Increased diversification;

When firms' activities are imperfectly correlated, the risk can be reduced through a Merger. This effect, as a result, will reduce expected default costs. Lewellen (1971) view of financial benefits was mainly founded on the assumptions that default cost creates positive financial synergies in a conglomerate firm. In his paper these "financial" possibilities occurs from:

- Temporary errors in the valuation of the target;
- Utilizing the unused debt capacity of a target firm;
- Reduction of total corporate earnings volatility from corporate diversification.

However, Lewellen(1971) assumed that financial benefits are *always* positive. If his reasoning is correct, we should not observe spin-offs of conglomerate firms since there are no *negative* financial synergies.

## 3.2 The Optimal Capital Structure

Our study, which is focused to understand whether financial synergies can be a driver of corporate spin-offs, requires model for firm capital structure. During the years, scholars have developed different capital structures. Here in this section we will highlight two main capital structures, which we think are relevant both for our study but also for historical purposes (cfr. M&M).

### 3.2.1 Modigliani and Miller 1958

In 1958, Modigliani and Miller, theorized two of the most important propositions in modern finance. However, the two authors made a series of strong assumptions, such as: (i) Frictionless Market; (ii) Competitive Markets; (iii) Homogeneous Information; (iv) No Taxes; (v) Firm's Cash-Flows are not dependent on its finance policy. While the two propositions elaborated by the two scholars are, nevertheless, still valuable they are not a good representation of the real world. In the following subsection, we will illustrate a two-period model of capital structure elaborated by Leland(2007). Yet, we will see its limitations and we will explain how to overcome its limitations in the methodology section of this thesis.

### 3.2.2 Leland 2007

Leland's 2007 capital structure relies on the two-period models elaborated by DeAngelo and Masulis(1980) and Kale, Noe, and Ramirez (1991). However, Leland distinguish between two types of cash-flows: (i) Activity cash flow; (ii) Corporate cash flow. Leland divided the cash flows in two groups. The latter group is influenced the boundaries of the firm and, thus, reflects the limited liability of the firm. What is more, the author, in his analysis, makes more realistic assumption regarding the interest payments. The scholar assumes that interest expenses are tax deductible. In spite of this better assumption, this creates a endogeneity problem. To overcome this issue, the author uses numerical techniques to find the optimal debt leverage and debt value.

#### I. Cash Flows, Taxes and Limited Liability

The following paragraphs rely on Leland(2007) paper. Let us consider two periods in a risk-neutral environment  $t=\{0, T\}$  where T represents the last period in our period-length. Let us define  $r_t$  as the risk-free interest rate for the entire period  $\{0, T\}$ , and  $X$  as the future *operational* cash flow at time  $t=T$ . As noted by Scott(1977) and Sarig(1985), and written by Leland, the *operational* cash flow might be non-positive. The risk neutral environment where we set our model, implies that  $X_0$  is the value of the *operational* cash flow at time  $t=0$  (present value) can be expressed as:

$$X_0 = \frac{1}{(1 + r_T)} \int_{-\infty}^{\infty} X dF(X), \quad (3.1)$$

where  $F(X)$  represents the *cumulative* probability distribution of the *operational* cash flow at time  $t=T$ . Limited liability permits equity holders to let the firm go bankrupt when cash flows are negative. As a result, the value of a limited-liability firm (pre-tax) is:

$$H_0 = \frac{1}{(1 + r_T)} \int_0^{\infty} X dF(X), \quad (3.2)$$

while the value (pre-tax) of the limited liability is:

$$L_0 = H_0 - X_0 \quad (3.3)$$

substituting eq. (1) and (2) we obtain:

$$-\frac{1}{(1 + r_T)} \int_{-\infty}^0 X dF(X) \geq 0. \quad (3.4)$$

Note:  $L_0 = 0$  occurs when the probability of non-positive future cash flows is zero.

Now, let us consider a firm that has no debt and where its equity holders enjoy limited liability.  $\tau$  represents the tax rate at which the cash flows are taxed. Inserting  $(1-\tau)$  in eq. (3.2) yields the after-tax value of this firm:

$$\begin{aligned}
H_0 &= \frac{1}{(1+r_T)} \int_0^\infty (1-\tau)X dF(X) \\
&= (1-\tau)H_0.
\end{aligned} \tag{3.5}$$

Finally, let us define  $T_0(0)$  equals to the amount of taxes (present value) paid by the equity-financed firm.

$$T_0(0) = \tau H_0 \tag{3.6}$$

## II. Debt, Tax Shield, and Firm Default

Relying on Merton(1974), Leland(2007) express the debt of a firm, as a zero-coupon bond issued at  $t=0$  with the principal ( $P$ ) due to time  $T$ . Following the notation, let  $D_0(P)$  represents the *market* value of the firm's debt at time  $t=0$ . The interest expense is expressed as

$$I(P) = P - D_0(P). \tag{3.7}$$

Recalling the more realistic assumption made by Leland (interest expenses are tax deductible), taxable income is represented by the difference between operational cash flows and interest payments ( $X - I(P)$ ).  $X^{BE}$  is defined as the zero-tax, level of cash flow ("break-even point"). Let us apply this definition and substituting eq.(6) into I(P) yields:

$$X^{BE} = I(P) = P - D_0(P) \tag{3.8}$$

Following the paper, Leland assumes that taxes have a "zero loss offset": No tax refunds are paid when  $X < X^{BE}$ . Let us write the present value of the future tax payments of a levered firm with debt equals to the value of the zero-coupon bond ( $P = \text{Debt Principal}$ ).

$$T_0(P) = \frac{\tau}{(1+r_t)} \int_{X^{BE}}^\infty (X - X^{BE}) dF(X). \tag{3.9}$$

Following Merton(1974) we can express the value of the equity as a call option with strike price equals to the zero-coupon bond issued by the firm. Note that equity is the residual value after deducting the repayment of the principal and the taxes. It has a lower bound equals to zero and an unlimited upper bound. Therefore,  $E$  (Equity) can be express as:

$$E = \text{Max}[X - \tau \text{Max}[X - X^{BE}, 0] - P, 0]. \tag{3.10}$$

Let's define default at time  $t$  as the negative equity cash flow( $E$ ) for this limited liability firm. Insolvency by the firm occurs when the cash flow generated by operations ( $X$ ) is less than the cash flow needed to the debt repayment ( $X^D$ ). As a result, we can express  $X^D$  as:

$$X^D = P + \tau \text{Max}[X^D - X^{BE}, 0].$$

Now, as Leland(2007), we want to demonstrate that  $X^D \geq X^{BE}$ . In order to show it, we

need to assume the contrary. Following from eq.(10) we observe that  $X^D = P$ . Recalling eq.(7) it can be observed  $X^{BE} = P - D_0 < P = X^D$ , which results in a contradiction. Following eq.(10) we have:

$$X^D = P + \tau(X^D - X^{BE}),$$

which implies (using eq.(7) and substituting it)

$$X^D = P + \frac{\tau}{(1-\tau)}D_0. \quad (3.11)$$

Given eq.(7) and eq.(11)  $D_0(P)$  can now be determined. If at time  $t=T$  the firm is solvent ( $X \geq X^D$ ) the debtholders will receive back the principal ( $P$ ). If, on the other hand, ( $X \leq X^D$ ) the firm is defaulting on its obligations. We will assume that debt-holders can recover a fraction of their investment ( $R$ : Recovery Rate) which is net of default costs ( $\delta$ ). This amount is calculated on the nonnegative (pre-tax)  $X$  (Operational Cash flow). Bondholders are protected by limited liability as well, they avoid payments when the operational cash flow is negative ( $X < 0$ ). Government has a seniority over bondholders, the latter need to take into account the tax liability of the firm ( $\tau(X - X^{BE})$ ) when  $X^{BE} \leq X \leq X^D$ . The discounted debt value of debt is therefore:

$$D_0(P) = \frac{P \int_{X^D}^{\infty} dF(X) + (1-\delta) \int_0^{X^D} X dF(X) - \tau \int_{X^{BE}}^{X^D} (X - X^{BE}) dF(X)}{(1+r_T)} \quad (3.12)$$

It is important to note that in eq. (12)  $X^{BE}$  and  $X^D$  are functions of  $D_0(P)$  (cfr. eq(7) and eq.(11)) The (expected) recovery rate on debt (after the taxes are paid) for bondholders is:

$$R(P) = \frac{\left( (1-\delta) \int_0^{X^D} X dF(X) - \tau \int_{X^{BE}}^{X^D} (X - X^{BE}) dF(X) \right) / \int_{-\infty}^{X^D} dF(X)}{P}. \quad (3.13)$$

It is worthwhile to point out that, as Leland(2007) in his paper noted, that the default costs ( $\delta$ ) is difficult to recover and observe. However, the author, in the rest of the paper, chooses a parameters that matches the actual recovery rates. Recalling that the equity value can be expressed as a call option with strike price equals to the debt level (equity holders will receive a positive cash flow whenever  $X \geq X^{BE}$ ). Finally, looking at the situation when  $X^D \geq X^{BE}$ , the equity can be determined as:

$$E_0(P) = \frac{1}{(1+r_T)} \left( \int_{X^D}^{\infty} (X - P) dF(X) - \tau \int_{X^D}^{\infty} (X - X^{BE}) dF(X) \right). \quad (3.14)$$

### 3.2.3 Optimal Capital Structure according to Leland(2007)

At  $t=0$ , the value of the leveraged firm, is equal to the sum of the debt value and the equity value:

$$V_0(P) = D_0(P) + E_0(P) \quad (3.15)$$



where  $D_0(P)$  and  $E_0(P)$  satisfy their respective equations. The optimal level of debt, which maximizes the leverage of the firm and its firm value, gives the optimal capital structure of the firm.

### 3.2.4 Gains from leverage

Leveraging an initial unlevered firm creates gains for the firm. These gains can be expressed as the difference between the value of the leveraged firm and the original unlevered value ( $V_{0L} - V_{0U}$ ). These gains are the present value of the difference between the tax savings due to interest expenses and the default costs. Therefore,  $V_{0L}$  can be expressed as:

$$V_{0L} = V_{0U} + \Theta_0(P) - \Lambda_0(P), \quad (3.16)$$

where  $\Theta$  represents the Tax Savings,  $\Lambda$  represents the bankruptcy (default) costs. Furthermore,  $\Theta$  is the difference between the tax levels of the unlevered firm and levered firm. Therefore,

$$\begin{aligned} \Theta_0(P) &= T_{0U} - T_{0L} \\ &= \tau H_0 - \frac{\tau}{(1+r_T)} \int_{X^{BE}}^{\infty} (X - X^{BE}) dF(X), \end{aligned} \quad (3.17)$$

using eq.(5) and eq.(8) and that  $\Lambda_0(P)$  is the discounted value of the default costs we have,

$$\Lambda_0(P) = \frac{\delta}{(1+r_T)} \left( \int_0^{X^D} X df(X) \right), \quad (3.18)$$

using eq.(11).  $V_{0U}$  is unlevered, so the maximization problem turns out choosing the appropriate level debt ( $P$ ) that optimize the difference of  $\Theta$  minus  $\Lambda$ .

## 3.3 Estimating Financial Synergies for firms

### 3.3.1 Financial Synergies

Following Leland(2007) paper we look at financial synergies for a firm with an optimal scope. The decision that Leland hypothesized is that the decision-maker has to decide whether to merge the two activities together ( $i=M$ ) and leverage the single firm or keep them separate and independently leverage the two firms ( $i=1,2$ ).

Given the scope of this study, financial benefits will be the main driver for corporate spin-offs or mergers. In this study, following Leland(2007), financial benefit of a corporate divestiture or merger  $\Delta$  is the difference between the leverage level of the merged firm and the sum of the two leverage levels of the separated firms:

$$\Delta \equiv v_{0M}^* - v_{01}^* - v_{02}^*, \quad (3.19)$$

let us recall that  $v_{0i}^* \equiv v_{0i}(P_i^*)$ ,  $P_i^*$  is the debt that maximizes the optimal firm value. Once more, let us recall that, positive  $\Delta$  implies that the two firms should merge. On the other hand, negative  $\Delta$  indicates that the two firms should separate to increase their values.

### 3.3.2 The three main components of Financial Synergies

$\Delta$ , recalling eq. (16) and eq.(20), can be decomposed into its three main components, namely:

- Change in the unlevered firm resulting from the merger:  $\Delta V_0 \equiv V_{0M} - V_{0A} - V_{0B}$  ;
- Change in the Tax Savings:  $\Delta \Theta \equiv \Theta_{0M} - \Theta_{0A} - \Theta_{0B}$ ;
- Change in Default Costs:  $\Delta \Lambda \equiv \Lambda_{0M} - \Lambda_{0A} - \Lambda_{0B}$ .

and this relationship can be expressed as,

$$\Delta = \Delta V_0 + \Delta \Theta - \Delta \Lambda \quad (3.20)$$

Leland(2007) notes that in spite of cash flow additivity, the merger can influence  $\Delta V_0$ . Assuming  $\tau$  is equal for all firms,  $\Delta V_0$  can be expressed as (recalling eq.(3) and eq.(19)),

$$\begin{aligned} \Delta V_0 &= (1 - \tau)(H_{0M} - H_{0A} - H_{0B}) \\ &= (1 - \tau)(X_{0M} - X_{0A} - X_{0B}) + (L_{0M} - L_{0A} - L_{0B}) \\ &= (1 - \tau)(L_{0M} - L_{0A} - L_{0B}) \\ &= LL \end{aligned} \quad (3.21)$$

let us define  $LL$  as  $LL \equiv (1 - tax)(L_{0M} - L_{0A} - L_{0B})$ .  $LL$  effect is never positive as Scott(1977), Sarig(1985) and Leland(2007) in their papers have reminded. Furthermore,  $LL < 0$ , if  $E(X) < 0$  and  $\rho$  (correlation between cash flows of firms) are not perfectly correlated. Finally, we can rewrite eq.(21) using eq.(22) and defining ( $LE \equiv \Delta \Theta - \Delta \Lambda$ ):

$$\Delta = LL + LE \quad (3.22)$$

## 3.4 Problems with Leland(2007) capital structure estimation

In the previous sections, we have developed and reported the model of optimal capital structure by Leland(2007). However, it is mainly based on operational cash flow, resulting in a challenge estimation of the latter. Yet, the majority of the studies on M&A and spin-offs have been based on the volatility of cash flow as a proxy for the riskiness of the firm. In spite of the apparent difficulties in estimation the firm's volatility, let us recall that the volatility of the asset can be a good proxy of the riskiness of the firm. It includes both

the risk that bondholders face as well as the equity holder's risk. As noted by Levine and Wu(2016) asset volatility can be estimated using the equity-to-value ratio and the firm's equity volatility, (cfr. Welch(2004) and Frank and Goyal(2006)). Levine and Wu(2016) note that as the leverage increases, the bias of this measure (represented by ignoring the riskiness of the debt) becomes more severe. What is more, we have a significant risk to obtain a spurious correlation. From the same paper, we can express the volatility of the two firms together as:

$$\mathbb{E}[\sigma_{A+B}] = \sqrt{v^2\sigma_A^2 + (1-v)^2\sigma_B^2 + 2v(1-v)\rho\sigma_A\sigma_B} \quad (3.23)$$

where  $v$  is the ration of the value of firm A to the sum of the merged firm ( $v \equiv (V_A)/(V_A + V_B)$  ).

### 3.5 Testable Hypothesis

In this study, two hypothesis are being tested:

#### *Hypothesis I*

Financial Synergies ( $\Delta$ ) are a driver of corporate spin-offs

#### *Hypothesis II*

The leverage level of the two separated firms will be greater than the leverage level of the merged firm (cfr.  $L(A) + L(B) > L(AB)$ ).

The next chapter will illustrate our methodology to recover the parameters needed in order to test our hypothesis and which tools we will use.

## Chapter 4

# Empirical Design of the study

### 4.1 Methodology

To test our hypothesis described in the previous section we need to develop the appropriate methodology for a study like ours. We, therefore, need to analyze the capital structure of the firms in our sample. Nonetheless we need to estimate the volatility of the two firms to test whether the propositions by Leland(2007) are correct. However, as noted in the previous chapter, the estimation of the business risk (i.e. volatility) through cash-flow is hard. Therefore, we will follow the framework used by Levine and Wu(2016). Yet, we encourage the reader to go to the data chapter to understand how the data selection is done. As a result, with the data in our availability, we would estimate the variables we are interested into. First of all, the volatility of the firm will be estimated using the share price of the firm in object. Furthermore, we will look at the capital structure before and after the spin-off occurs. Moreover, we will analyze only financial synergies as the main driver of spin-offs. However, we want to remind the reader that financial synergies are supplement to operational synergies. As a result, the former synergies are not substitutes of the latter.

### 4.2 Statistical tools

We will, whenever necessary, use regressions to test our hypothesis as well as draw conclusions from our study. Our study will try to infer from a sample of firms whether firm synergies can be a driver of corporate spin-offs. As a result, statistical tools (such as OLS regression) will help us to generalize the effect of financial synergies to the population.

## Chapter 5

# Sample selection

### 5.1 Data

The data to form our sample are obtained from Thomson Reuters SDC Platinum database. We firstly set a time span that would cover the period 1984-2016. In our first analysis, we started including public and private firms. From an initial screening we obtained data on 4396 spinoffs in the period mentioned above. To further refine our sample and find data on the companies we will apply the following filters: (i) The parent company is a public firm; (ii) The spun-off firm is a public firm. To recover data useful for the analysis of their capital structure we will consult the CRSP database. We plan to research data on both the unified firm before the spin-off and the resulting entities. What is more, we plan to recover the share price from public available databases. As a result, this will give us the necessary information to recover the volatility of the firm.

# Appendix A

## Bibliography

- Banal-Estaol, A., Ottaviani, M., & Winton, A. (2013). The Flip Side of Financial Synergies: Coinsurance Versus Risk Contamination. *The Review of Financial Studies*, 26(12), 40. doi:10.1093/rfs/hht049
- Berger, P. G., & Ofek, E. (1999). Causes and Effects of Corporate Refocusing Programs. *The Review of Financial Studies*, 12(2), 34. doi:10.1093/rfs/12.2.311
- Chemmanur, T. J., & Kose, J. (1996). Optimal Incorporation, Structure of Debt Contracts, and Limited-Recourse Project Financing. *Journal of Financial Intermediation*, 5(4), 36. doi:10.1006/jfin.1996.0021
- Daley, L., Mehrotra, V., & Sivakumar, R. (1997). Corporate focus and value creation evidence from spinoffs. *Journal of Financial Economics*, 45(2), 257-281
- DeAngelo, H., & Masulis, R. W. (1980). Leverage and dividend irrelevancy under corporate and personal taxation. *The Journal of Finance*, 35(2), 453-464. doi:10.1016/0304-405X(80)90019-7
- Desai, H., & Jain, P. C. (1999). Firm performance and focus: long-run stock market performance following spinoffs. *Journal of Financial Economics*, 54(1), 75-101
- Dittmar, A. (2004). Capital Structure in Corporate Spin-Offs. *The Journal of Business*, 77(1), 35. doi:10.2139/ssrn.217429
- Frank, M. Z. & Goyal, V. K. Testing the pecking order theory of capital structure, *Journal of Financial Economics* 67, 217-248.
- Fulghieri, P., & Sevilir, M. (2011). Mergers, Spinoffs, and Employee Incentives. *The Review of Financial Studies*, 24(7), 35.
- Galai, D., & Masulis, R. W. (1976). The option pricing model and the risk factor of stock. *Journal of Financial Economics*, 3(1), 53-81. doi:10.1016/0304-405X(76)90020-9
- Gertner, R., Powers, E., & Scharfstein, D. (2002). Learning about Internal Capital Markets from Corporate Spinoffs. *The Journal of Finance*, 57(6), 2479-2506. doi:10.1111/1540-6261.00503
- Hearth, D., & Zaima, J. K. (1984). Voluntary Corporate Divestitures and Value. *Financial Management*, 13(1), 7. doi:10.1111/j.1540-6288.1995.tb00824.x

- Hite, G. L., & Owers, J. E. (1983). Security price reactions around corporate spin-off announcements. *Journal of Financial Economics*, 12(4), 409-436. doi:10.1016/0304-405X(83)90042-9
- Inderst, R., & Miller, H. (2003). Internal vs. External financing: An optimal contracting approach. *Journal of Finance*, 58(3), 29. doi:10.1111/1540-6261.00557
- Handbook of Empirical Corporate Finance SET* (2008). (E. Espen Ed.): North Holland.
- John, T. (1993). Optimality of spinoffs and allocation of debt. *Journal of Financial and Quantitative Analysis*, 28(1), 21. doi:10.2307/2331155
- Johnson, G. A., Brown, R. M., & Johnson, D. J. (1994). The Market Reaction to Voluntary Corporate Spinoffs: Revisited. *Quarterly Journal of Business and Economics*, 33(4), 16.
- Kale, J. R., Noe, T. H., & Ramirez, G. G. (1991). The effect of business risk on corporate capital structure: Theory and evidence. *The Journal of Finance*, 46(5), 1693-1715. doi:10.1111/j.1540-6261.1991.tb04640.x
- Kose, J., Lang, L. H. P., & Netter, J. (1992). The Voluntary Restructuring of Large Firms in Response to Performance Decline. *The Journal of Finance*, 47(3), 27. doi:10.1111/j.1540-6261.1992.tb03999.x
- Kraus, A., & Litzenberger, R. H. (1973). A statepreference model of optimal financial leverage. *The Journal of Finance*, 28(4), 911-922. doi:10.1111/j.1540-6261.1973.tb01415.x
- Krishnaswami, S., & Subramaniam, V. (1999). Information asymmetry, valuation, and the corporate spin-off decision. *Journal of Financial Economics*, 53(1), 73-112. doi:10.1016/S0304-405X(99)00017-3
- Leland, H. E. (1994). Corporate Debt Value, Bond Covenants, and Optimal Capital Structure. *The Journal of Finance*, 49(4), 39. doi:10.2307/2329184
- Leland, H. E. (2007). Financial Synergies and the Optimal Scope of the Firm: Implications for Mergers, Spinoffs, and Structured Finance.. *Journal of Finance*, 62(2), 42. doi:10.1111/j.1540-6261.2007.01223.x
- Levine, O., & Wu, Y. (2016). Asset Volatility and Financial Policy: Evidence from Corporate Mergers. *Finance Down Under 2016 Building on the Best from the Cellars of Finance*, 50. doi:10.2139/ssrn.2399154
- Lewellen, W. G. (1971). A Pure Financial Rationale for the Conglomerate Merger. *Journal of Finance*, 26(2), 16. doi:10.1111/j.1540-6261.1971.tb00912.x
- MacMinn, R. D., & Brockett, P. L. (1995). Corporate spin-offs as a value enhancing technique when faced with legal liability. *Insurance: Mathematics and Economics*, 16(1), 63-68. doi:10.1016/0167-6687(94)00035-D
- Mehrotra, V., Mikkelsen, W., & Partch, M. (2003). The Design of Financial Policies in Corporate Spin-Offs. *The Review of Financial Studies*, 16(4), 30. doi:10.1093/rfs/hhg027
- Merton, M. H. (1977). Debt and Taxes. *Journal of Finance*, 32(2), 14. doi:10.2307/2326758
- Miles, J. A., & Rosenfeld, J. D. (1983). The effect of voluntary spinoff announcements on shareholder wealth. *The Journal of Finance*, 38(5), 1597-1606. doi:10.1111/j.1540-6261.1983.tb03843.x

- 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.
- Schipper, K., & Smith, A. (1983). Effects of recontracting on shareholder wealth: The case of voluntary spin-offs. *Journal of Financial Economics*, 12(4), 437-467. doi:10.1016/0304-405X(83)90043-0
- Sarig, O. H. (1985). On mergers, divestments, and options: A note. *Journal of Financial and Quantitative Analysis*, 20(03), 385-389. doi:10.2307/2331038
- Scott, J. H. (1977). Bankruptcy, secured debt, and optimal capital structure. *The Journal of Finance*, 32(1), 1-19. doi:10.1111/j.1540-6261.1977.tb03237.x
- Seoungpil, A., & Denis, D. J. (2004). Internal capital markets and investment policy: evidence from corporate spinoffs. *Journal of Financial Economics*, 71(3), 27. doi:10.1016/S0304-405X(03)00165-X
- Shah, S., & Thakor, A. V. (1987). Optimal capital structure and project financing. *Journal of Economic Theory*, 42(2), 34. doi:10.1016/0022-0531(87)90086-X
- Subrahmanyam, A., & Titman, S. (1999). The goingpublic decision and the development of financial markets. *The Journal of Finance*, 54(3), 1045-1082. doi:10.1111/0022-1082.00136
- Tirole, J. (2006). *The Theory of Corporate Finance*: Princeton University Press.
- Vijh, A. M. (1994). The Spinoff and Merger Ex-Date Effects. *The Journal of Finance*, 49(2), 29. doi:10.1111/j.1540-6261.1994.tb05153.x
- Welch, I. (2004). Capital structure and stock returns. *Journal of political economy*, 112(1), 106-132. doi:10.2139/ssrn.298196