



# Value Creation Through Corporate Restructuring: A Case study of the spin-off of REC Solar ASA

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# Abstract

This thesis presents a detailed analysis of the spin-off in REC ASA to show how corporate reorganization can enhance the value of a firm operating in a challenging industry. The goal of the study was to determine whether the separation of REC ASA's module and polysilicon units generated value and, if it did, what the sources were. The research followed a funneling approach, where the initial research fathomed broadly before singling out the most important aspects of the transaction. This included an analysis of empirically proven value drivers, industry and firm specific factors, before ending with a thorough analysis of the key characteristics of the transaction.

The study finds that the spin-off generated an abnormal return of 19.53 percent immediately following the announcement, while the longer event windows were affected by conflicting announcements making the abnormal return output unreliable. The announcement was also associated with a positive reaction in bond prices, establishing that the separation was value enhancing also for the debt holders. The analysis of value drivers shows that the company was trading at a relative discount prior to the spin-off and that the discount was eliminated following the announcement. The key value driver in the transaction was that it solved the firm's cash shortage problem by bringing its cash balance in excess of its short debt maturities. In addition, it improved the strategic position of both parent and subsidiary by eliminating the silicon unit's exposure to the underperforming solar unit and positioning the solar unit for the expected challenges of the module industry.

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# 1. Introduction

## 1.1 Problem statement

The overarching goal of this thesis has been to find a compelling answer to the following research question:

Did the spin-off in REC ASA generate shareholder value, and if it did, what were the underlying value drivers?

The research was initiated with an analysis of all the potential factors impacting the deal, including a thorough analysis of industry and firm specific factors. However, after preliminary research, it became evident that the most important aspect of the deal was its impact on the financial strength of both parent and subsidiary. The analysis was therefore restructured to focus on the relation between the spin-off and REC ASA's debt situation. The refocusing was also necessary to reduce the 120-page first draft to the advisor's maximum of 50 pages. The final draft incorporates the key findings of the industry and strategic analysis, while discussing and modeling the impact of the debt related issues in detail.

## 1.2 Motivation and the writing process

Our motivation was to gain a better understanding of the processes and factors surrounding a major corporate transaction. This could have been achieved in an empirical study, but we found it more interesting and relevant to do a single company study, as it would give us useful experience from incorporating information from interviews and financial analysis to models that could rationalize the motivation behind the transaction and replicate the observed market reaction.

The writing process has been challenging and has required research on a number of topics, as one answer typically created a new question. This led to a time consuming process where a variety of models were developed to replicate the observed market reaction. Many of which did not offer the "evidence" we were looking for. In the end, writing this thesis has been an interesting and educational process that has improved our understanding of, and ability to, apply financial theories and methodologies to a market event.

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## Why REC ASA?

We chose REC ASA as a target for our study because it is an interesting company operating in an intriguing and volatile industry. In addition, it has recently been involved in a number of controversial transactions, making it an interesting target for a single company study. Choosing a Norwegian company was also convenient, as it gave us access to analysts and employees who had been involved in the spin-off process.

## 1.3 Background

The completion of the spin-off in REC ASA marked the end of a yearlong effort to restructure the company's debt securities. In the mid 2000s, REC ASA was considered a leader in the promising but immature solar industry. With a constrained supply side and rapidly growing subsidized demand, industry participants saw their share price skyrocketing. However, as experienced by most industries earning super profits, the solar industry attracted capital and went through an investment boom. REC ASA joined in on the investment bonanza and initiated a NOK 30 billion debt financed expansion plan in 2006/2007. This was reflected in the company's debt/equity ratio that increased from 24 percent in December 2006 to 71 percent in December 2009.

The debt financing was reasonable at the time, as the promising industry outlook gave REC ASA an apparently strong debt servicing ability. However, by the time the new production facilities were fully operational (2010), the market conditions had deteriorated with solar panel prices reduced to 1/4 of the pre-investment level (Ferrarar et al., 2010). This left REC ASA with a substantial debt burden and insufficient cash generation to retire its debt obligations. While fresh capital from numerous secondary offerings kept the firm afloat, the debt situation took its toll on firm value, as its market capitalization went from NOK 18.6 billion to NOK 2.5 billion and its relative pricing from a 76 percent premium to a 64 percent discount from 2010 to 2012.<sup>1</sup>

At the time of the spin-off, REC ASA was fully integrated in the up-stream solar supply chain, with production of polysilicon and manufacturing of solar modules. REC Silicon's proprietary polysilicon purification process (FBR) made it a cost leader, with cash costs/kg USD 3-5 below

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<sup>1</sup> The relative pricing data is derived from the sum of the parts analysis presented in section 5.1

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the industry average. REC Solar was a tier one manufacturer with the most advanced production facilities in the industry (analyst interviews). The plant had higher maintenance costs, but its modules had industry-leading efficiency and were therefore selling at a premium.<sup>2</sup> In addition, both units had pipeline investment opportunities that would support their industrial position.

The sentiment in the solar industry was twofold, with a challenging present and a promising future. Following the rapid expansion in the solar supply chain from 2006 to 2010, the solar industry was going through a shakeout stage (Klepper & Gort, 1982), where only the firms with a sufficient buffer were expected to survive.<sup>3</sup> From 2010 to 2013, the total number of firms in the upstream photovoltaic (PV) supply chain declined from 750 to 150 (HIS Solar Research), mainly due to bankruptcy. This stabilized the supply/demand relationship in polysilicon, but the module manufacturing industry was still fragmented and prone to oversupply.

The challenging conditions had eliminated much of the industry's equity, but also positioned solar power for future success. The decline in output prices had required tough cost cutting programs, allowing solar power to approach retail grid parity in an increasing number of markets.<sup>4</sup> With an upward trend in the cost of traditional energy sources and an increasing focus on sustainable and environmentally friendly energy, the upside for the companies surviving the shakeout stage was considerable.

### **Structure of the thesis**

This thesis will consist of four sections. Section (1) introduces corporate restructurings, vertical integration theory and a review of the existing body of literature on spin-offs. Section (2) presents an overview of the motivations and key characteristics of the spin-off, to show how company- and industry conditions impacted the management's design of the transaction. Section (3) presents an abnormal return analysis of the REC ASA spin-off to show how the market evaluated the transaction. Section (4) concludes the thesis with an analysis of the debt situation in REC ASA and its relation to the observed market reaction.

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<sup>2</sup> The panels were selling at a premium ranging from 5-7 percent of the quoted market price.

<sup>3</sup> Shakeout stage associated with a 90 percent decrease in the number of suppliers and an increase in the concentration of the top five producers by as much as 40 percent (Klepper & Simons, 2005)

<sup>4</sup> Retail grid parity exists when solar power is cost competitive with other sources of energy.

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## 2. Literature review

The following section presents an overview of the existing literature relevant to the topic. It begins by introducing corporate restructurings in general and divestitures in particular, before discussing the positive and negative effects of operating in a multi-unit firm. The review is concluded with an overview of the existing literature on the market reaction to spin-off announcements and the associated value drivers.

### 2.1 Corporate Restructurings

Corporate restructurings include all actions taken by a corporation to alter the legal-, ownership-, or operational structure of a company, with the motivation to either increase or decrease the firm's operational asset base (Khan & Mehta, 1996). Restructurings pursued to expand the scope of a firm are commonly referred to as mergers and acquisitions (M&A), while restructurings pursued to reduce the scope of the firm are known as divestitures. While both M&As and divestitures are interesting topics, the divestiture literature is the most relevant and will therefore be emphasized in the following sections.

#### 2.1.1 Divestitures

“Divestitures entail a partial or full disposal of a business unit (subsidiary) through sale, exchange, closure or bankruptcy” (Investopedia, 2014). In the transaction, the ownership of the assets is either transferred to existing shareholders or to an external buyer in return of cash, securities, or a combination of the two (Eckbo and Thorburn, 2013).

The specific structure of a divestiture depends on the divestment strategy. The three most frequently pursued divestiture strategies are sell-offs, spin-offs, and carve-outs (PwC, 2012). Whereas sell-offs include the complete disposal of a portion of a firm's assets to a third party, a spin-off transfer the ownership of the firm to existing shareholders as a pro-rata dividend, and equity carve-outs dispose the subsidiary through an initial public offering (IPO).

#### 2.1.2 Spin-offs

As opposed to the other divestment strategies, straight spin-offs do not raise any capital and do not include an external buyer. This makes spin-offs interesting transactions, as they alter the

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structure of the firm while the ownership and capital base is constant. Any observed change in value following the announcement should therefore be related to the isolated effects of the reorganization. In addition, the value generated in a spin-off is not dependent upon the buyer's willingness to pay and should therefore be overrepresented by undervalued subsidiaries. A spin-off is therefore a strong candidate for a single event-study, as the undervaluation should generate a higher market reaction and the constant ownership should reduce the extraneous factors, making it easier to apply financial theories and models to the divestiture process and the associated market reaction.

### 2.1.3 Characteristics of divested entities

Generally, companies going through divestitures are associated with lower cash flows and capital expenditures, as well as higher book-to-market ratios, leverage, dividend yield, information asymmetry and within-firm diversification relative to comparable firms (Chen & Guo, 2005). In addition, divestiture activity is found to increase under unfavorable economic and industry conditions (Eriksson and Kuhn, 2006). According to managers, divestitures are pursued to increase industrial focus or divest underperforming units, and to improve the operational-, managerial- and financial aspects of both the parent and the divested entity (Mukherjee et al., 2004; Ofek, 1993). Thus, divestitures are overrepresented by firms experiencing both internal and external challenges. Among divestitures, firms disposing an undervalued subsidiary prefer spin-offs, as it avoids selling the firm at a discount and internalizes any post-transaction gains (Michaely & Shaw, 1995).

### 2.1.4 Characteristics of divestiture industries

Spin-offs are overrepresented in advanced, innovative or fragmented industries where the industry cycle is still considered emerging. In this part of the cycle, existing players and new entrants can both grow without cannibalizing each other, thus incentivizing entrepreneurial behavior like spin-offs (see e.g. Cooper, 1985; Arthur, 1990; Daneels; 2002).

## 2.2 Value and the boundary of the firm

A divestiture in a vertically integrated firm is value generating if the divested subsidiary is worth more outside than inside the firm. This condition is commonly referred to as a conglomerate discount, defined as the undervaluation of a firm operating within an integrated firm relative to a

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comparable firm operating as a pure play (Investopedia, 2014). To generate a framework for the analysis, this section will present the dominant theories on the positive and negative effects of vertical integration.

### 2.2.1 Vertical Integration Theory

The literature on vertical integration is built on three dominant frameworks, the transaction cost approach, the industrial organization perspective, and the resource-based view. The transaction cost approach defines the optimal boundary of the firm as the point where the cost of doing an internal transaction is equal to the cost of doing it externally. The industrial organization perspective focuses on how integration can generate competitive advantages given the competitive nature of the industry in which it operates. While the resource based view focuses on how the combination of resources along a supply chain can generate a durable competitive advantage. These theories will be briefly discussed in the following section.

#### **Transaction cost approach**

Ronald Coase (1937) defines transaction costs as the costs associated with a firm's exchange of goods and services. They arise due to imperfect markets in which a company should vertically integrate to limit its exposure to the open market and thereby reduce its costs. Oliver Williamson (1981) argues that an imbalance in supply and demand can greatly affect the transaction costs of goods with high asset specificity, thus motivate the firm to internalize its value chain.

#### **Industrial organization perspective**

Industrial organization (IO) explains how the market influences the strategy- and decision making of a company (Barthwal, 2010; Tirole, 1988). Michael Porter's 5-forces is one of the most adapted and acknowledged approaches to IO and is a common framework used to determine corporate strategy and seek out profitability and attractiveness for a company. Firms can create competitive advantage either by low cost or differentiation, which can be achieved by (1) Combined operations, (2) Internal control and coordination, (3) Information, (4) Avoiding the open market and (5) Stable relationships (Porter, 1981).

#### **The resource based view**

The Resource Based View (RBV) is established on the idea that a firm's competitive advantage

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depends on the effective and efficient application of its internal resources and capabilities (see e.g. Barney, 1991; Grant, 1991, Wernerfeldt, 1984). To increase a firm's competitive advantage, the resource needs to be (1) Valuable, (2) Rare, (3) Imperfectly mobile and (4) Non substitutable, also referred to as the VRIN model (Barney, 1991). Unless an asset passes the VRIN-test a company should turn to the open market rather than vertically integrate.

### **Vertical integration and its benefits, disadvantages and common fallacies**

Another potential benefits from vertical integration, originally taken from conglomerate theory, and not mentioned in the three previous frameworks is the access to internal capital markets. Instead of raising equity or debt, a vertically integrated company can transfer capital internally, typically referred to as cross-subsidization (Williamson 1975; Stein, 1997). However, research suggests that cross subsidization can lead to overinvestment in weak segments and underinvestment in high growth segments relative to its stand-alone peers (Scharfstein and Stein, 2000).

On a general note, companies have a tendency of overestimating the value effects from integration (McKinsey, 2012). Vertical integration is an expensive strategy that can decrease a firm's financial flexibility, hamper its growth prospect and come at the expense of existing competencies being neglected. If expanding outside its core operations, bureaucracy can increase and agency issues can arise as divisions might be managed at arm's length (Jensen & Meckling, 1976; Maksimovic & Phillips, 2002).

All of these factors can then lead to a conglomerate discount, defined as the difference in relative value of a diversified firm compared to a single-segment firm; empirically proven by Berger and Ofek (1995). According to research, the average conglomerate discount is in a range from 13-15 percent of firm value.

The global economy speaks in favor of disintegration as deregulation and emerging markets have made the open market more competitive. In addition, improved information flow and technology have decreased the information asymmetry and lowered the transaction costs. In many industries the technological complexity has made it harder for companies to maintain excellence in multiple

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areas, and forced them to channel their focus on fewer core competencies in order to maintain their competitive edge. As vertical integration is hard to reverse and an expensive strategy to pursue, management should thoroughly consider all alternative options before making a decision.

### 2.3 Market reactions to spin-offs

Prior research finds immediate positive price reactions to spin-off announcements (see e.g. Hite & Owers, 1983; Cusatis et al., 1993; Veld & Veld-Merkoulova, 2008). The long-term effects, on the other hand, are more questionable. Early studies found that spin-offs generated abnormal returns for as long as 36 months following the announcement/IPO (see e.g. Cusatis et al., 1993; Desai & Jain, 1999). However, later studies have failed to find similar results, claiming that the stock market effect is limited to the days around the divestiture announcement (see e.g. McConnell et al., 2001; Veld & Veld-Merkoulova, 2004). According to a recent meta-study by Veld and Veld-Merkoulova (2008) the announcement day gain is 3.02 percent.

Considering the uniformity of the short-term findings, spin-offs appear to be value-generating transactions. However, the value appears to be generated immediately, suggesting that firms involved in spin-offs are trading at a discount that is eliminated following the announcement. This observation also shows that markets are efficient at evaluating the impact that the spin-off will have on a firm's future performance.

With the clean-cut nature of spin-offs, the value generation should be related to the elimination of negative synergies rather than the generation of positive synergies in the new operating structure. A number of studies (see e.g. Veld & Veld-Merkoulova 2004; Desai & Jain 1999; Daley et al. 1997) find positive returns associated with focus increasing spin-offs, claiming that cross-industry spin-offs are particularly value generating as they eliminate the conglomerate discount of the subsidiary while reducing the complexity of the parent company. Value generation in the parent firm is typically associated with reduced agency issues, as it becomes easier to establish effective incentive based contracts following the separation (Schipper & Smith, 1983).

Studies looking specifically at the causes of negative synergies find that announcement day returns are positively correlated with the pre spin-off level of capital misallocation (McNeil &

Moore, 2005), information asymmetry (Krishnaswami & Subramaniam,1999), and agency problems (Schipper & Smith, 1983). Thus, one can assume that these problems are reduced or eliminated following the spin-off.

According to a study by Gertner et al. (2002), the investment strategy of spun off subsidiaries moves more in tandem with industrial peers following the spin-off, while the study by Krishnaswami & Subramniam (1999) finds that the level of information asymmetry declines following the spin-off. In the article by McNeil & Moore (2005), it is established that spin-offs reduce agency costs, as incentive based contracts are easier to implement. Studies focusing on other effects of spin-offs find that the market reaction is positively correlated with industry takeover activity (Harris & Glegg, 2008) and subsidiary size (Klein, 2001), and negatively correlated with creditor protection (Parrino, 1997).

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## 3. Spin-off deal overview

### 3.1 The transaction - Background and key characteristics

The spin-off, announced on July 18, 2013, intended to completely separate the integrated solar and silicon assets in REC ASA. This was to be achieved by moving the solar assets into a new publicly listed company named REC Solar ASA. The public listing was to be combined with a rights issue of 40 million shares at a subscription price of NOK 20,<sup>5</sup> raising a total of NOK 800 million. The funds raised to the company were to be transferred to the parent company, as compensation for the solar assets. In return, the solar assets were to be transferred carrying no debt obligations, a cash balance of NOK 300 million, and a revolving credit line from the parent company of NOK 200 million. A consortium consisting of existing shareholders in REC ASA guaranteed the rights issue.

The goal of the restructuring was to improve the company's short-term debt situation while maintaining the ownership concentration of existing shareholders. Initial discussions included a sell-off, but with considerable price uncertainty,<sup>6</sup> a credit constrained solar industry, high asset specificity, and few potential buyers, the value of the solar assets were expected to carry a considerable discount (Shleifer & Vishny, 1992). By choosing a spin-off with a rights issue, the company strengthened the balance sheet of both parent and subsidiary, maintained ownership concentration, and internalized any post-transaction gains.

The deal structure was impacted by its need to obtain creditor consent. The NOK 800 million raised in the restructuring improved the firm's ability to retire two large debt tranches with a total face value of NOK 1.9 billion (more than 50 percent of outstanding debt) maturing in Q2 and Q3 2014. Moving all the debt to the parent company appeared to be the only solution, as REC Solar ASA had no debt carrying ability.<sup>7</sup> REC Silicon ASA did also have proprietary rights to a new polysilicon purification technology (FBR-B) that would allow it to generate cash flow through up front fees from technology sharing contracts (e.g. joint venture) if its cash balance should fall

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<sup>5</sup> 58 REC ASA shares per subscription right

<sup>6</sup> Analyst estimates prior to the announcement valued the solar assets from NOK 0 to NOK 1.9 billion.

<sup>7</sup> REC Solar ASA was unable to get any form of credit guarantees from external parties (analyst interviews)

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short of its 2014 maturities.

The announcement of the asset separation did not take the market by surprise, as rumors and even demands of a restructuring had circulated the market place for some time. The strategic analysis shows that the benefits of vertical integration had diminished. Oversupply of polysilicon had eliminated the cost and quality advantages of upstream integration, while the forward integration into module manufacturing gave REC Silicon exposure to an industry that was even more prone to overcapacity, due to lower entry barriers, a shorter production cycle and commoditization.<sup>8</sup>

Internally, the company had been looking for a feasible solution to its debt problems in the challenging solar market. Its actions to date included a gradual discontinuation of its Scandinavian production units (24.05.11 - 24.04.12), a proposed and partially completed restructuring of the firm's debt securities (22.06.12), a private placement (04.07.12), a controlled bankruptcy of its subsidiary REC Wafer (14.08.12), a repair offering (04.09.12), and a partial restructuring (14.05.13). While several options were discussed going into 2013, improved conditions in REC ASA during Q2 2013 persuaded the management team that REC Solar would be self-sustainable and that a spin-off was the optimal solution (Kjell Christian Bjørnsen). For a more detailed description of the events, please refer to Appendix C.

The use of existing shareholders as guarantors generated two benefits. The direct effect was approximately NOK 60 million in reduced guarantor fees.<sup>9</sup> More importantly, having key investors, such as Øystein Stray Spetalen and Jens Ulltveit Moe,<sup>10</sup> guaranteeing for the deal provided important support for the transaction. While it is difficult to estimate the direct effect, a study by Bay and Amundsen (2011) find a statistically significant abnormal return in the Norwegian stock market from transactions that are supported by celebrity investors, suggesting that their support positively impacted the market reaction following the announcement.

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<sup>8</sup> The information represents the key findings of the strategic analysis that due to the length requirement has been excluded. For additional work on the boundaries of the firm, see for instance Coase (1937) and Williamson (1981) – transaction cost approach, Barney (1991) – resource based view and Porter (1981) – industrial organization.

<sup>9</sup> Typical fee for bank guarantees is 10 percent (DNB), while the guarantee consortium would receive a maximum fee of 2 percent depending on the length of the guarantee period.

<sup>10</sup> Guaranteeing NOK 90 million (11 percent) and NOK 262.5 million (33 percent), respectively.

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The transaction shared characteristics with many empirically proven value-drivers. The firm's revenue lacked transparency and had a high relative pre-transaction information asymmetry, as measured by the volatility in analyst earnings estimates relative to its peers. The capital allocation was inefficient, as REC Silicon had superior growth opportunities, as measured by its post spin-off multiple, but was required to use its free cash flow to keep the solar unit solvent. Finally, the within industry market for corporate control was expected to pick up with improved industry conditions and a number of large corporations looking for exposure to the upside in the solar industry. The positive spin-off reaction could therefore be related to an increased attractiveness as a target. In support of this, the board agreed (November 2013) on a clause where Ole Enger (leader of the board and former CEO) would receive a one-time bonus if more than  $\frac{2}{3}$  of the shares in REC Solar ASA were acquired by a single investor within 24 months.<sup>11</sup>

### 3.2 Key events in the spin-off period (18.07.13 - 23.09.13)

The spin-off in REC ASA coincided with a number of other events likely to impact the market's valuation.

1. The spin-off was announced together with the Q2 2013 earnings report. The report showed that Q2 sales exceeded expectations by NOK 144 million, while earnings after tax were NOK 250 million below estimates. The effect of the earnings report appears ambiguous. However, adjusted earnings were better than expected and the segment report confirmed the observed improvements in both REC Silicon and REC Solar. In addition, the company had increased its production and stacked up on inventory, awaiting an anticipated price increase of modules in the European market following the introduction of a volume cap and price floor on Chinese manufactured solar panels being introduced in August.
2. At 10.00 AM on the announcement day, China introduced a tariff on polysilicon produced in the U.S. (53.3-57 percent) and Korea (2.4-48.7 percent). REC ASA had 54 percent of its polysilicon revenue from China and was subject to the highest rate (REC ASA Annual Report – 2012). This created uncertainty around the cash generating ability of REC Silicon and questioned whether the spin-off would obtain consent from creditors.<sup>12</sup>

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<sup>11</sup> The information represents the key findings of the empirical value driver analysis that due to the length requirement has been excluded. See e.g. Wang (1993) for a description of the method used to estimate information asymmetry and e.g. Scharfstein & Stein (2000) for a description of the efficient capital allocation test.

<sup>12</sup> The effect of the polysilicon tax has been limited and will therefore not be discussed further.

3. On July 23, Citi Bank issued a report claiming that the spin-off would fail to get creditor consent, due to the polysilicon tariff.
4. On August 12, REC ASA announced a debt restructuring, including the issue of a new convertible bond and a partial repurchase of the firm's outstanding debt that would extend its maturity schedule.
5. On August 23, REC ASA improved its refinancing offer to include a larger buyback on the firm's outstanding debt.
6. On August 27, REC ASA's creditors gave consent to the spin-off.
7. On September 23, the management team gave their consent and the transaction was confirmed.

### 3.3 Intraday and spin-off period share price development

Figure 1 illustrates the news flow and the corresponding volatility of the share price on the announcement day. The Q2 earnings and the spin-off were announced before the market opened (06.56 AM). Following the opening, the share price rose to NOK 4.00 ("overreaction"), representing a gain of 23.6 percent from prior day's close. After the initial price reaction, the price dropped before stabilizing around NOK 3.80 ("true market reaction"). This was followed by a decline caused by the tariff announcement at 10.00 AM, which brought the share price down to NOK 2.93 before recovering and closing at NOK 3.25, for a daily gain of 2.85 percent.

FIGURE 1 SHARE PRICE - INTRA ANNOUNCEMENT DAY

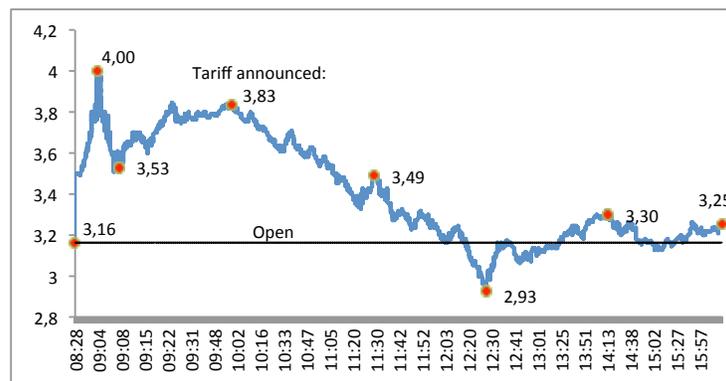
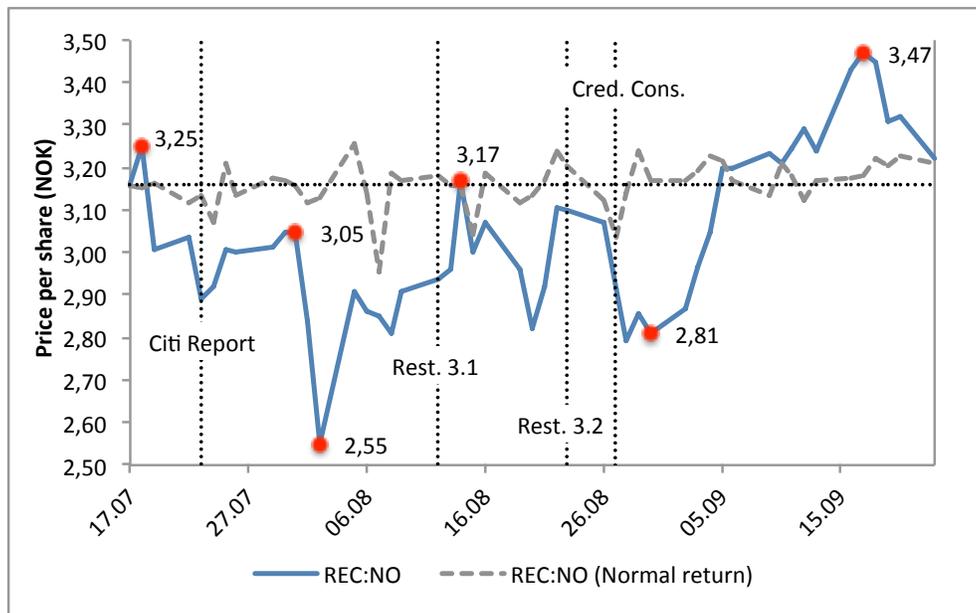


Figure 2 shows the share price development in REC ASA from the spin-off announcement until the transaction was confirmed. After a moderate announcement day gain, the share price struggled with the uncertainty generated by the Chinese tariff. The local minimum was reached on August 2nd following an investor sell-off, before the share price made a slight recovery prior to the announcement of the restructuring (12.08.2013). In the period following creditor consent (27.08.13), the share price experienced a positive trend reaching a local maximum of NOK 3.47 on September 17, before ending the period with a slight decline. Comparing the share price development to its “normal” return highlights REC ASA’s high exposure to the Chinese market relative to its industry peers and the inconsistent development of the share price following the announcement.

FIGURE 2 DAILY CLOSE SHARE PRICE DURING THE EVENT WINDOW



Caption: The graph compares REC ASA’s share price with the normal return used in the abnormal return analysis presented in section 4.

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## 4. Abnormal return analysis

The following section will introduce the data and methodology that will be used in the abnormal return analysis followed by the output. For a more detailed description, see MacKinlay (1997).

### 4.1 Event window

The event of interest in an event study is typically the announcement day. However, most studies use an extended event window, typically including at least the announcement day and the following day (MacKinlay, 1997). Generally, shorter event-windows are associated with more reliable results (Andrade et al., 2001), as the market reaction is less likely to be impacted by other factors than the event one is studying. On the other hand, shorter event-windows can fail to capture the true announcement effect, as the market's initial reaction can be irrational.

The analysis will include a number of event windows to evaluate the potential market price effect of key announcements taking place in the spin-off period. The events that will be evaluated include the spin-off announcement (18.07.13), the Citi report (23.07.13), the first debt-restructuring announcement (12.08.13), and the bondholder approval announcement (27.08.13). Ideally, the analysis would include the long-run effects of the spin-off. However, due to the volatility generated by industry- and firm specific news, it would be difficult to isolate the effect of the separation and it has therefore not been pursued.

### 4.2 Estimation window

The estimation window should include a sufficient number of data points while ensuring relevancy. According to MacKinlay (1997), the event-window typically ranges from 120 to 360 data points. The estimation-window in this study is determined by relevancy. To assure that the estimation period is representative to REC ASA at the spin-off announcement date the estimation period will commence twenty days after the controlled bankruptcy of the wafer operations in Scandinavia on August 14, 2012.

The estimation- and event-window typically do not overlap, as the abnormal return in the event-period would impact the expected return model (MacKinlay, 1997). To avoid this effect and

allow for pre-announcement studies, the estimation window will end twenty-one days prior to the announcement date (18.07.13) while the event-window will commence twenty days prior to the same date. The time windows are displayed in Table 1.

TABLE 1 ESTIMATION- AND EVENT WINDOW

<b>Window</b>	<b>Start</b>	<b>End</b>	<b>Tot. # of data points</b>
Estimation	12.09.12	19.06.13	189
Event	20.06.13	23.09.13	48

### 4.3 Data

The announcement and creditor approval dates have been derived from Oslo Access and NewsWeb, the official information and news database for all firms listed on the Oslo Stock Exchange. Stock data has been derived from the Capital IQ database, as it offers a broad range of securities and indexes. The only exception is intra day data for REC-NO, which has been derived from the Oslo Stock Exchange. The analysis will use log-normal nominal stock returns, as customary when using daily stock returns as input data (MacKinlay, 1997).

### 4.4 Normal return

The normal return in the event window will be estimated using the market model. A number of other methods were tested, including CAPM and the constant return model but they both showed a lower ability to predict normal returns and produced similar results to the market model. The analysis could have included a multifactor model but the benefits were not expected to exceed the complexity and time of developing an appropriate model (Brown & Warner, 1980) and it was therefore not pursued.

### 4.5 Market model index

According to MacKinlay (1997), the market index should be derived using a broad based stock index. However, the solar industry had been struggling with overcapacity since 2009, and the market movements had therefore been uncorrelated with broader market indexes. Finding an index with a stronger explanatory ability, as measured by its R-squared, was therefore necessary.

For reference, a number of indexes were tested, including the OSEBX (headquarter), S&P 500 (proxy for market portfolio), a China specific index (main source of revenue), two industry specific indexes (SUNIDX and SOLRX), and a “homemade” index consisting of REC ASA and its peers. For the derivation of the homemade index, please refer to Appendix A.<sup>13</sup>

As shown in Table 2, the “homemade” index generated the highest R-squared followed by the industry specific indexes. Surprisingly, OSEBX provided a relatively high R-squared, potentially due to its high correlation with the energy sector. The R-squared of the broad market indexes show that these are inappropriate as parameters in the market index. Due to its explanatory ability, the “homemade” index was used in the abnormal return analysis.

TABLE 2 REGRESSION OUTPUT

	<b>^SOLRX</b>	<b>MAC Global Solar Energy Index</b>	<b>Oslo Bors Benchmark Index</b>	<b>^SPX</b>	<b>MXCN</b>	<b>Homemade Index</b>
<b>R-squared</b>	8.24%	7.87%	6.91%	1.30%	2.38%	15.22%
<b>Y-intercept</b>	-2E-06	0.00	0.00	0.00	0.00	0.00
<b>Beta</b>	0.69	0.67	2.17	0.95	0.96	1.32

Caption: The table shows the different indexes’ explanatory ability measured by their R-squared.

## 4.6 Estimating statistical significance

The estimate of statistical significance will be based on the standard deviation of the abnormal return experienced in the estimation window, as it is expected to be more representative to the normal variability in REC ASA.

## 4.7 Adjustments to the abnormal return analysis

Due to the announcement of earnings, spin-off, and polysilicon tariff occurring on the same day, the analysis will take into account the expected effects of the conflicting events.

1. Empirical data suggests that positive earnings announcements are associated with a positive

<sup>13</sup> Of the “home made” indexes the average return model provided the strongest explanatory ability and is therefore used. The index consists of 20 solar and silicon companies.

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return, but the market effect is typically gradual (post announcement drift) (Kothari, 2001). Thus, based on empirical data the effect of the earnings announcement should not significantly alter the abnormal return analysis. However, considering that the positive performance of the solar unit was a key factor impacting the decision to pursue the spin-off, its impact on the observed abnormal return cannot be disregarded.

2. To account for the market's reaction to the announcement of the polysilicon tariff, the study will use intra day prices. The Chinese ministry of commerce announced the polysilicon tariff at 10.00 AM Norwegian time (16.00 local time).<sup>14</sup> The last price recorded prior to this announcement (NOK 3.83) will be used as a proxy for the markets reaction to the spin-off. The analysis included an attempt to adjust for the price effect experienced by firms with similar exposure to the tariff, but no publicly traded comparable firms were found.
3. The announcement of the debt restructuring (12.08.13) included the issue of a new USD 110 million convertible bond and a partial repurchase of the firm's outstanding bonds. Empirically, the announcement of new convertible debt is followed by a negative share price reaction (see e.g. Eckbo et al., 2007), as it potentially dilutes the ownership of existing shareholders. This effect is stronger when issued to roll over old debt, as it, per se, does not impact future cash flow prospects but is likely to increase the number of shares outstanding (Julio, 2007). The positive effect of the debt restructuring could therefore be offset by its potential dilutive effect.

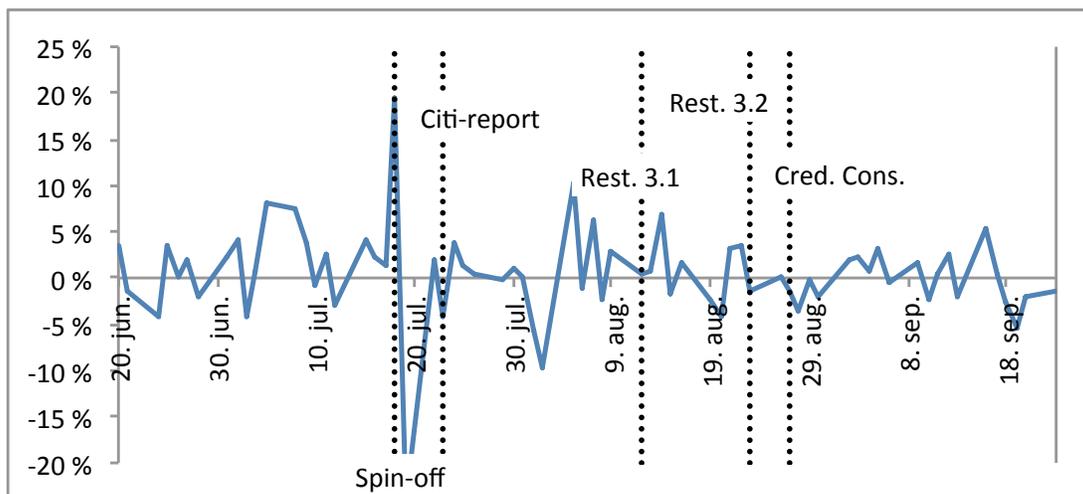
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<sup>14</sup> <http://www.mofcom.gov.cn/article/ae/ai/201307/20130700206270.shtml>

## 4.8 Findings - Abnormal return analysis

The findings of the abnormal return analysis are impacted by the simultaneous events around the announcement of the spin-off. It is therefore difficult to draw a definite conclusion. However, the price level experienced prior to the announcement of the polysilicon tariff shows a statistically significant (99% level) abnormal return of 19.53 percent, suggesting that the announcement was value generating. The complete output of the abnormal return analysis can be found in Appendix B.

FIGURE 3 ABNORMAL RETURN



Caption: The graph shows the abnormal return in the event-window based on the pre-tariff-announcement share price of NOK 3.83 (June 18, 2013 to September 23, 2013).

### 4.8.1 Announcement day abnormal return

The announcement day abnormal return analysis using the pre-tariff announcement price (NOK 3.83) shows a statistically significant (99%) abnormal return of 19.53 percent, while the  $t\pm 20$  event-window shows a statistically significant (95%) abnormal return of 0.93 percent. The remaining event-windows produce statistically insignificant positive and negative abnormal returns.

The pre- and post-announcement event-windows show that the statistically significant (95%) abnormal return in the +/- 20 event -window is driven by a positive pre-announcement market reaction. This could be due to information leakage, but it is unlikely considering the significant return on the announcement day. Instead, it appears to be driven by improved conditions in REC ASA.<sup>15</sup>

TABLE 3 OUTPUT STATISTICS ON SPIN-OFF ANNOUNCEMENT

	t +/- 0	t +/- 1	t +/- 3	t +/- 5	t +/- 10	t +/- 20	t -20/+47
Abnormal Return	19,53 %	-3,11 %	1,28 %	6,24 %	21,50 %	38,26 %	34,28 %
Average Abormal Return	19,53 %	-1,04 %	0,18 %	0,57 %	1,02 %	0,93 %	0,50 %
N	1	3	7	11	21	41	68
t-stat	95 %						
Statistical Significance	6,60	-0,61	0,16	0,64	1,59	2,02	1,41

#### 4.8.2 Citi report abnormal return

The abnormal return following the publication of the Citi report was negative but statistically insignificant, suggesting that the information was expected in the marketplace and already incorporated into the share price.

TABLE 4 OUTPUT STATISTICS ON CITI-REPORT PUBLICATION

	t +/- 0	t +/- 1	t +/- 3	t +/- 5	t +/- 10	t +/- 20
Abnormal Return	-4,07 %	1,77 %	-0,88 %	3,66 %	4,29 %	35,50 %
Average Abormal Return	-4,07 %	0,59 %	-0,13 %	0,33 %	0,20 %	0,87 %
N	1	3	7	11	21	41
t-stat	95 %					
Statistical Significance	-1,38	0,35	-0,11	0,37	0,32	1,87

#### 4.8.3 Debt restructuring abnormal return

The abnormal return analysis presented in Table 5 shows a statistically significant (95%) average abnormal return in the t +/- 5-day event window of 1.97 percent. This observation is driven by an

<sup>15</sup> The analysis included an estimation of the abnormal return excluding the implied effect of the tariff announcement. This produced a statistically significant abnormal return in all estimation windows. However, this result is dependent upon its assumptions and has therefore not been included.

abnormal return in excess of 10 percent experienced on August 5, caused by a bounce back from a 10.77 percent drop on the prior trading day caused by an investor sell-off. The abnormal return data shows a positive trend, suggesting that the market evaluated the restructuring positively, but that a restructuring was anticipated and therefore already incorporated in the share price.

TABLE 5 OUTPUT STATISTICS ON DEBT RESTRUCTURING ANNOUNCEMENT

	t +/- 0	t +/- 1	t +/- 3	t +/- 5	t +/- 10	t +/- 20
Abnormal Return	0,47 %	4,29 %	15,15 %	21,71 %	8,38 %	17,67 %
Average Abnormal Return	0,47 %	1,43 %	2,16 %	1,97 %	0,40 %	0,43 %
N	1	3	7	11	21	41
t-stat	95 %					
Statistical Significance	0,16	0,84	1,93	2,21	0,62	0,93

#### 4.8.4 Creditor consent abnormal return

The abnormal return analysis displayed in Table 6 shows that the abnormal return around the creditor consent date is negative in most event-windows and statistically insignificant in the ones where the return is positive. This is driven by a negative post-consent return. The pre-consent return, on the other hand, was positive suggesting that the market anticipated creditor consent, making the announcement less important.

TABLE 6 OUTPUT STATISTICS ON CREDITOR CONSENT

	t +/- 0	t +/- 1	t +/- 3	t +/- 5	t +/- 10	t +/- 19
Abnormal Return	-1,35 %	-4,81 %	-4,86 %	1,88 %	6,12 %	3,06 %
Average Abnormal Return	-1,35 %	-1,60 %	-0,69 %	0,17 %	0,29 %	0,08 %
N	1	3	7	11	21	39
t-stat	95 %					
Statistical Significance	-0,46	-0,94	-0,62	0,19	0,45	0,17

#### 4.8.5 Full period abnormal return (see section 4.8.1)

The full event period (t-20/+47) average abnormal return was statistically insignificant (+0.5%). While this suggests that the announcement did not generate value, the moderate return can be traced back to the negative effect of the polysilicon tariff. REC ASA's exposure to the Chinese market exceeded any of the firms included in the "homemade" index, and the abnormal return

analysis resembles this.

#### 4.8.6 Summary - Abnormal return analysis

The announcement day abnormal return shows a statistically significant abnormal return (19.53 percent) while the returns experienced around the remaining events were statistically insignificant. This suggests that the additional announcements were already expected by the market and therefore failed to generate direct market reactions. The analysis section will therefore emphasize the information that was available in the market place directly following the announcement of the spin-off.<sup>16</sup>

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<sup>16</sup> To control for potential correlation between REC ASA and the homemade index, the abnormal return analysis was run using the broader MAC Global Solar Energy Index and OSEBX as input in the normal return model. To control for misrepresentation in the estimation period due to the many restructurings performed by the firm, the abnormal return analysis was run with an estimation period before the first restructuring in REC ASA. The output using these as input factors were not significantly different from the ones presented above.

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## 5. Analysis of value drivers

The abnormal return analysis showed that the spin-off in REC ASA generated an abnormal return of 19.53 percent. Compared to an empirical proven abnormal return for spin-offs around 3 percent (Veld & Veld-Merkoulova, 2008), the market reaction was above expectations. This suggests that there were deal specific characteristics that allowed the spin-off to generate more value than comparable transactions. The following section will investigate the details of the transaction to better understand the sources of the observed gain.

### 5.1 Relative valuation - Sum-of-the-Parts Analysis

The literature confirms that spin-offs are associated with immediate announcement gains typically resulting from the elimination of negative synergies. A natural starting point is therefore a sum-of-the-parts (SOTP) analysis. A SOTP analysis determines the “fair” value of a multi unit firm by adding up the industry multiple based value of each business unit. If the “fair” value exceeds the observable market value, the firm is trading at a discount. If the opposite is true, it is trading at a premium. Considering the result of the abnormal return analysis, one can expect that REC ASA was trading at a discount prior to the spin-off announcement and that it was reduced or eliminated following the spin-off.

The SOTP analysis presented below is based on an EV/Fwd Revenue multiple, as a majority of the firms in REC ASA’s peer group had negative EBITDA in the observation period. No representative industry benchmark multiple was found, and a multiple based on each business unit’s peer group was therefore developed. To assure that the industry multiple was representative to REC ASA, it was derived by weighting the multiple found for each industry with the respective business units share of REC ASA’s total revenue.

Table 7 compares the annual industry multiple with that of REC ASA.<sup>17</sup> The comparison proves REC ASA’s strong industrial position following its IPO, with a multiple two times that of its industry. It also confirms our expectations, as REC ASA was trading at a discount the year before

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<sup>17</sup> The company selection is based on modifications of Standard and Poor’s selection criteria, conversations with industry analysts and own research. The index includes 22 solar and 14 silicon companies, a sufficient number to eliminate 90 percent the firm specific risk (Reilly et al., 2005). The data is collected from Capital IQ’s database.

the spin-off announcement and the discount was eliminated following the spin-off.

TABLE 7 HISTORICAL EV/FWD REVENUE

Year	Industry	REC ASA
2006	5.0	9.5
2007	7.6	15.4
2008	1.5	2.8
2009	1.9	3.5
2010	1.3	1.7
2011	0.9	0.9
2012	1.7	0.8
2013	2.2	2.6

Caption: The table shows the industry- and REC ASA's year-end EV/Fwd Revenue multiple

To add more detail to the analysis, a SOTP analysis based on a pre and post spin-off announcement multiple is presented in Table 8 below. It shows that the 64 percent relative discount that the firm was trading under at year-end 2012 was reduced to four percent prior to the spin-off announcement. The spin-off turned the relative pricing into an 11 percent premium, before ending the year at a 39 percent premium.<sup>18</sup> This proves that the spin-off eliminated any negative synergies that the company was trading under and that the separation was followed by a strong performance by both business units.

TABLE 8 SOTP ANALYSIS

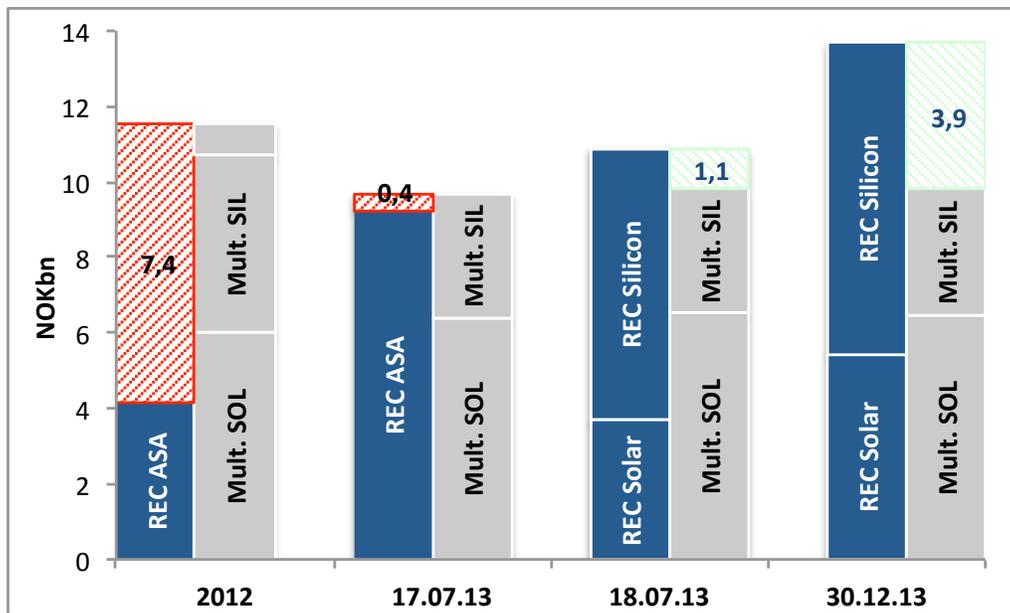
SOTP Analysis (NOKbn)							
in NOKbn	REC EV	Implied Solar EV	Implied Silicon EV	Implied Wafer EV	Implied EV	Premium NOK	Premium %
2012	4,2	6,0	4,7	0,9	11,6	-7,4	-64 %
2013 (July 17)	9,3	6,4	3,3	0,0	9,7	-0,4	-4 %
2013 (July 18)	10,9	6,5	3,3	0,0	9,8	1,1	11 %
2013	13,7	6,4	3,4	0,0	9,8	3,9	39 %

Caption: Dispersion between actual and implied EV value for REC ASA 2012-2013, based on year-end multiples and forward revenue estimates

<sup>18</sup> The SOTP announcement day calculation uses pre-tariff EV. If applying the closing EV instead, the SOTP analysis shows a 2 percent discount. The REC EV value in 2013 is the cumulative enterprise value of REC Silicon ASA and REC Solar ASA.

Figure 4 below compares the observed value of REC Solar ASA and REC Silicon ASA to their multiple based values. It shows that REC Silicon ASA was trading at a NOK 3.9 billion premium following the spin-off announcement, while REC Solar ASA traded at a NOK 2.8 billion discount. This suggests that the value generated in the spin-off was centralized in REC Silicon ASA. However, considering that REC Solar ASA was valued below NOK 1 billion prior to the spin-off and that the company should trade below its industry peers due to its higher maintenance cost, the true value distribution is difficult to determine.

FIGURE 4 SOTP ANALYSIS



Caption: The graph shows the development of REC ASA's EV (left) relative to the multiple based value (right). The green and red areas display the relative premium or discount. The top of the multiple graph in 2012 represents the wafer multiple. The EV distribution on 18.07.13 is based on the implied EV of REC Solar ASA.

The SOTP analysis proves that the spin-off brought the value of REC ASA from a discount to a premium price. However, it also shows that a majority of the discount that the firm was trading under at the end of 2012 was eliminated prior to the spin-off, suggesting that there were other factors than the spin-off that positively impacted the valuation of the firm.

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## 5.2 Debt securities

Using EV as the measurement of firm value incorporates the value of debt, equity, and the firm's cash balance. Considering that the abnormal return analysis only evaluates equity, this section will analyze the impact the deal had on the firm's outstanding debt securities.

Historically, spin-off transactions have impacted value to creditors (e.g. wealth transfer in the Marriott spin-off, as analyzed by Parrino, 1997). This is applicable in the REC ASA spin-off, as debt followed the parent company while the subsidiary emerged debt free. However, with debt covenants preventing alterations to the asset base without creditor consent and status quo being an alternative, a negative price reaction to the firm's debt securities is unlikely.

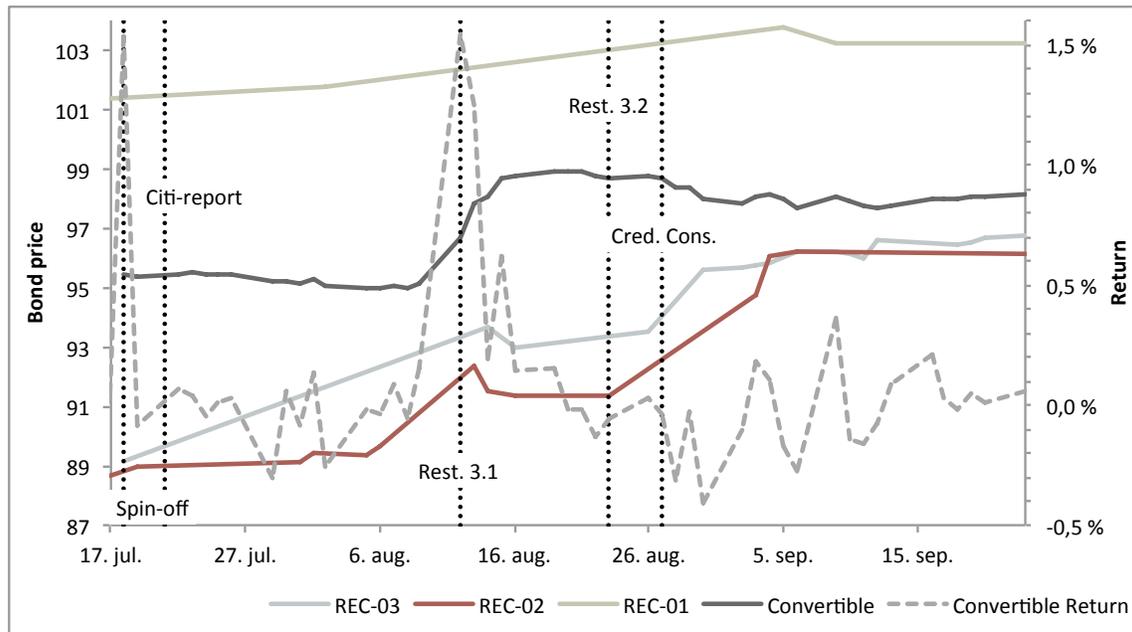
The debt reaction analysis would optimally include an estimate of the abnormal return (as presented in Parrino 1997), but REC ASA's debt traded too infrequently. The trend of bond prices, displayed in Figure 5 below, shows that all outstanding debt moved in a positive trajectory following the announcement of the spin-off, with full period gains ranging from 2.2 to 8.2 percent. The moderate announcement day gain shows that the announcement of the polysilicon tariff made creditors reluctant, as they were doubting the cash generating ability of REC Silicon.

The figure also includes the daily return of the convertible, which shows that the two key events were the initial spin-off announcement and the announcement of the initial restructuring (Rest. 3.1), generating a gain of 1.53 and 1.54 percent,<sup>19</sup> respectively. The more moderate return in REC ASA's bonds suggest that the spin-off mainly impacted the upside to shareholders.

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<sup>19</sup> The +/- 5 event window for the initial restructuring produce a 4.1 percent gain.

FIGURE 5 BOND PRICES



Caption: The graph presents the price change in REC ASA's outstanding bonds (left axis) in the spin-off period and the return in REC ASA's convertible bond (right axis).

### 5.3 Comparative analysis - relative competitiveness

The SOTP analysis proved that the value generation in the spin-off was related to a real and relative multiple expansion. However, basing the SOTP analysis on a revenue multiple makes the implicit assumption that all firms have an equal cost structure and does not take into account the financial situation of each firm, both potential sources of the observed discount. This section will therefore analyze the historical development of key ratios in REC ASA relative to its peers. The observation period will run from Q1 2012 to Q3 2013<sup>20</sup> to incorporate the period where the relative discount developed and the effect of the spin-off. As debt was a recurrent issue, the analysis will focus on ratios related to liquidity, leverage and cash flow.

#### Credit ratios

The general credit analysis shows a negative trend in REC ASA's leverage and liquidity ratios prior to, and during the discount period. However, the trend can also be observed in REC ASA's

<sup>20</sup> Q2 2013 adjusted for the incremental effect of the spin-off will be used in the ratios where it is more representative to the market sentiment.

peers and is therefore insufficient to explain the observed discount.<sup>21</sup>

Among the bankruptcy specific ratios that were tested, REC ASA's Altman Z-score, a common indicator of bankruptcy risk, was consistently below that of its industry. As displayed in Table 9 below, REC ASA was in the distress zone (<1.81) in the entire observation period. In addition, from Q2 2012 to Q2 2013, REC ASA, as the only one in the observation group, was trading below the average score (-0.25) found in the bankruptcy group of Altman's initial study (Altman, 1968). The data also shows that the score improved following the spin-off announcement, suggesting that the spin-off generated value by reducing the firm's bankruptcy risk.

TABLE 9 ALTMAN Z-SCORE

	Q1-12	Q2-12	Q3-12	Q4-12	Q1-13	Q2-13	Q3-13
First Solar	1.58	2.14	1.89	2.25	1.86	1.90	2.97
Sun Edison	0.67	0.96	0.84	0.88	0.61	0.53	0.67
Wacker	2.13	2.06	1.96	1.39	1.67	1.75	1.86
REC ASA	0.22	-1.02	-0.46	-0.76	-0.84	-0.29	0.85

The firm specific analysis shows that REC ASA's main concern was a short debt schedule, as more than 50 percent of its debt was maturing in 2014. Comparing the average maturity rate to that of the firms with a similar capital structure shows that REC ASA had a consistently lower rate throughout the observation period.

### Cash flow ratios

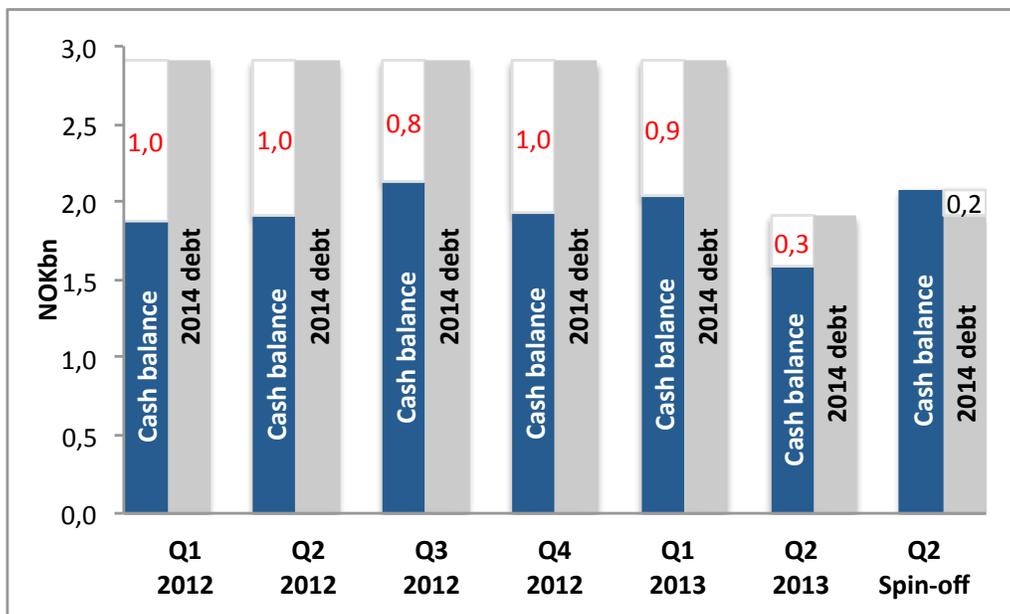
The cash flow analysis shows that REC ASA's gross margin declined more than that of its industry peers, due to high cash costs in REC Solar.<sup>22</sup> This negatively impacted the company's cash generating ability, which, in itself, supports the observed discount. However, combining this observation with the higher bankruptcy risk, and the shorter debt maturity schedule, it appears evident that the discount in REC ASA was related to an expected cash shortage.

<sup>21</sup> The comparable companies include the non-Chinese cost leaders in the silicon and solar industry, as cited by Citi Bank Research Report. The Chinese players are excluded, as their capital structure tends to be significantly different than the rest of the industry.

<sup>22</sup> Gross margin was the only operational cost ratio that was positive throughout the observation period.

To illustrate the relationship between REC ASA's bankruptcy risk, its short debt schedule, and the spin-off transaction, Figure 6 shows the company's quarterly cash balance relative to its 2014 maturities. As can be observed, the company was dependent upon approximately NOK 1 billion in additional cash to meet its debt obligations from Q1 2012 to Q1 2013. This dependency declined to NOK 0.3 billion in Q2 2013 before the NOK 500 million raised in the spin-off eliminated it. Knowing that REC ASA's relative discount declined in Q2 2013 and was eliminated following the spin-off, it appears evident that the discount was related to the firm's free cash to debt situation.

FIGURE 6 CASH BALANCE TO DEBT



Caption: The graph shows the relationship between REC ASAs quarterly cash balance and its debt maturing in 2014. The numbers above each bar represents the necessary cash generation until debt maturity.<sup>23</sup>

<sup>23</sup> The graph excludes an outstanding credit facility with a face value of NOK 1.6 billion maturing in April 2013 because it was retired prior to the discount period. The company did also have an undrawn credit facility (NOK 2 billion, later reduced to NOK 400 million), but it was maturing in Q2 2014 and did therefore not impact the firm's debt servicing ability.

## 5.4 Cash flow analysis

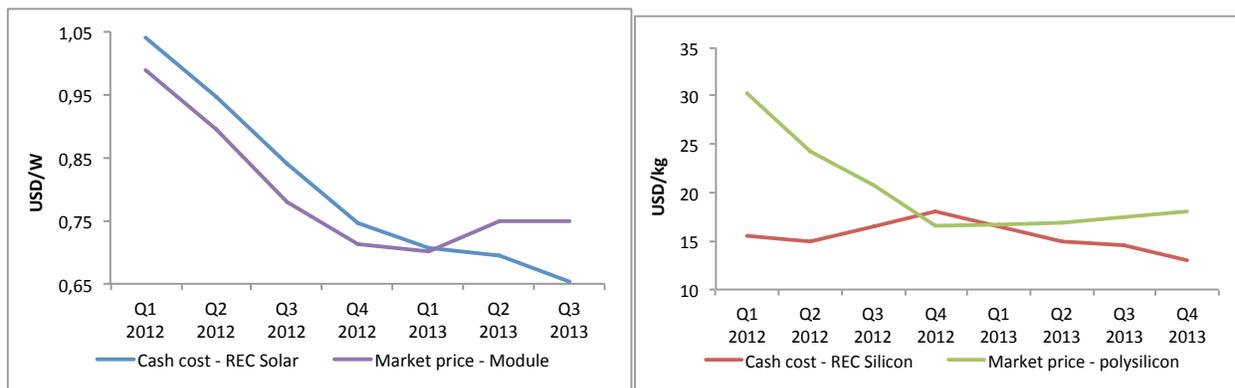
The ratio analysis indicates that the change in REC ASA's relative pricing was related to a higher relative bankruptcy risk, a short debt maturity schedule, and cash costs above the industry average. In addition, the company was dependent upon future cash generation to retire its 2014 maturities. To model the connection between REC ASA's share price and its bankruptcy risk, this section will analyze the company's ability to generate cash from internal sources.

### 5.4.1 Cash flow from operations

#### Sources of cash

REC ASA's main sources of revenue were polysilicon and solar modules, and its cash generation was therefore dependent upon the relationship between the market price and cash costs of these goods. As shown in Figure 7 below, the negative trend in REC ASA's margins coincided with its relative discount, with negative margins at year-end 2012 that gradually improved leading up to the spin-off.<sup>24</sup>

FIGURE 7 GROSS MARGINS REC SOLAR & REC SILICON



Caption: The graphs show the relationship between REC ASA's cash costs and the price level of polysilicon and modules.<sup>25</sup>

<sup>24</sup> The graph shows the cash costs for polysilicon produced with REC's FBR technology.

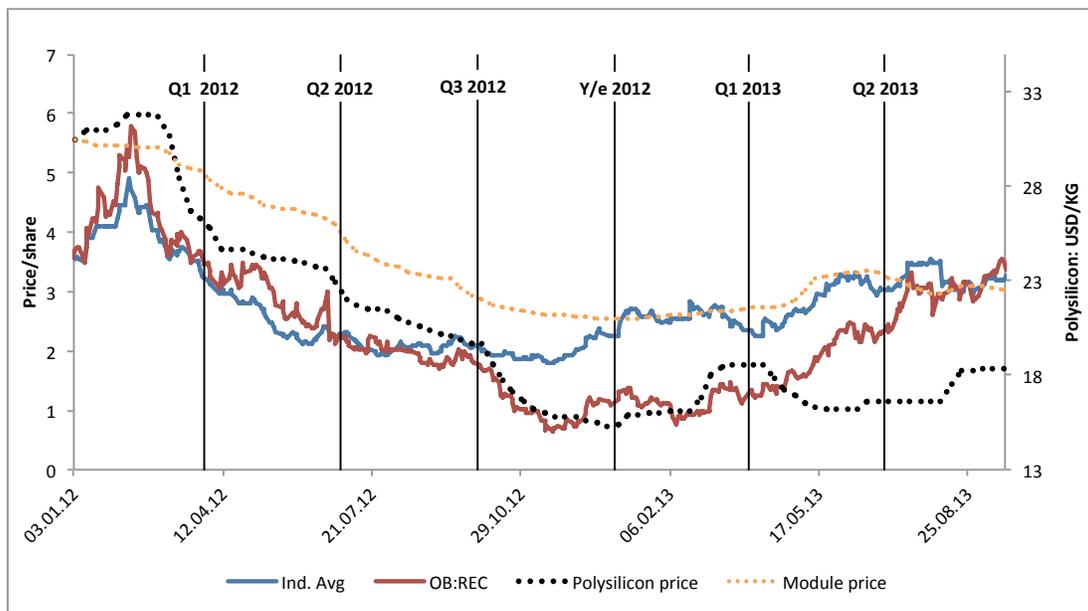
<sup>25</sup> The module price includes the 6% premium that REC ASAs modules were selling at.

## Output and share price connection

The negative trend in the price/cash cost relationship can also be observed in the share price of REC ASA. As shown in Figure 8 below, REC ASA's share price and the industry average followed the negative trend in the output prices of both polysilicon and modules at the beginning of 2012. However, the continuous drop in polysilicon prices following Q3 2012 caused the price of REC ASA to diverge downwards from the rest of the industry, generating the relative discount that was observed in the SOTP analysis. This suggests that REC ASA was more sensitive to this decline than its competitors.

This is surprising considering that REC ASA, as a polysilicon cost leader, should thrive in a low cost environment. However, this appears to be due to the company's dependence on a minimum polysilicon price level to generate sufficient cash to retire its debt. A similar price pattern can be observed in REC ASA's bonds, offering further support to this claim (see Figure 5).

FIGURE 8 SHARE PRICE AND OUTPUT PRICES



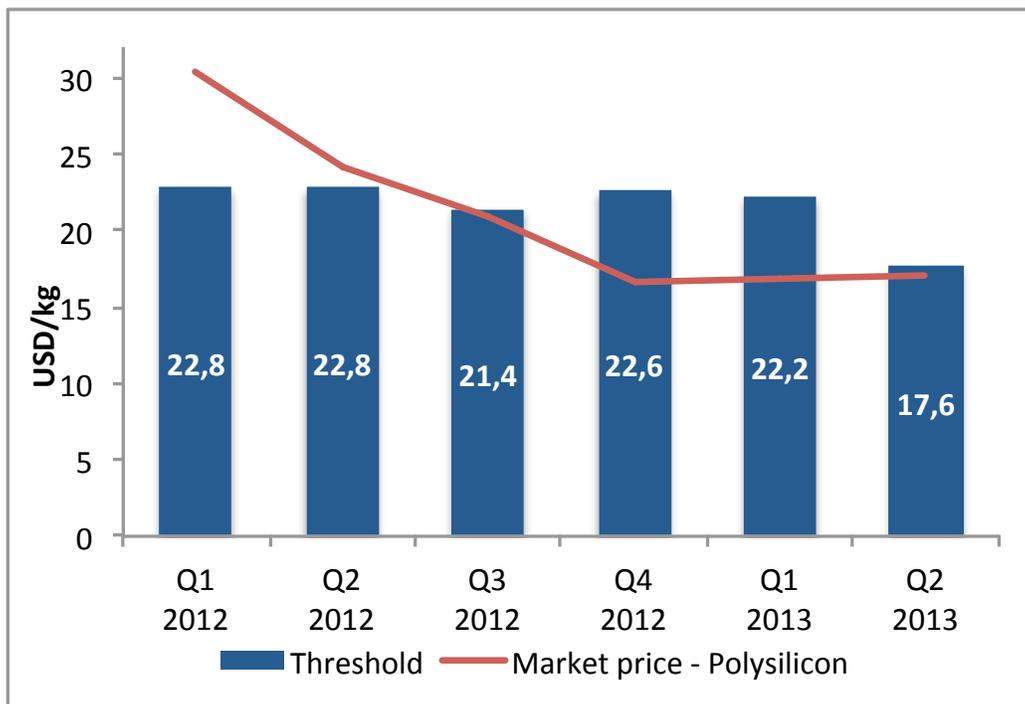
Caption: The graph shows the price development of REC ASAs equity relative to the industry average. The industry average is rebased with the share price of REC ASA and modules prices are rebased with the polysilicon price, as of 04.01.1

### Threshold polysilicon price

To test REC ASA's sensitivity to the polysilicon price, the company's cash generation was estimated in a quarterly cash flow model with the polysilicon price as a flexible variable and the remaining variables determined by market expectations.<sup>26</sup>

The output of the analysis, displayed in Figure 9 below, shows that the market price fell below the threshold during Q3 – 2012. This coincided with the discount in REC ASA's equity and proves that the relative discount is directly linked to REC ASA's cash generation and the development of the polysilicon price. The graph also shows that the reduced face value of its short debt and improved market conditions during Q2 2013 reduced the threshold towards the running market price, suggesting that the cash shortfall risk was limited by the time of the spin-off.

FIGURE 9 POLYSILICON TRESHOLD PRICES



Caption: The graph shows the relationship between the lowest polysilicon price (threshold) that would allow REC ASA to meet its debt obligations with internally generated cash and the average polysilicon price in the past quarter.

<sup>26</sup> Price levels based on analyst reports on the polysilicon and module prices. Cost estimates based on REC ASA's quarterly guiding.

### Estimating the cash shortfall risk

The cash flow analysis proves that the discount in REC ASA was correlated with a drop in the polysilicon price that reduced the probability of the company being able to meet its short debt with internally generated funds. To determine the cash shortfall risk, this section will estimate REC ASA's quarterly cash generating ability from the time of the spin-off until the maturity of the debt.

Using a cash flow model based on pre spin-off analyst estimates shows that in a base case scenario with a polysilicon price of 20 USD/kg, the company would be able to service its debt. Adding sensitivity to the model shows that a five percent decline in the expected price path or a six percent decline in expected volume of the company's end products would cause REC ASA to default. As the current spot price at the time of the announcement was around 17 USD/kg and trending downward, the chances of default was still pressing.

FIGURE 10 CASH FLOW SCENARIOS

NOKm	Q2E-13	Q3E-13	Q4E-13	Q1E-14	Q2E-14	Q3E-14
<b>Consensus</b>						
Ending Cash Balance	1 600	1 605	1 656	1 753	644	91
<b>Price Sensitivity -5%</b>						
Ending Cash Balance	1 600	1 602	1 634	1 707	575	-1
<b>Volume Sensitivity -6%</b>						
Ending Cash Balance	1 600	1 601	1 632	1 706	575	0

Caption: The table shows expected cash balance for REC ASA after interest and debt repayment for the period Q2-13 to Q3-14.

Considering REC ASA's short-term cash flow problems, the spin-off can be evaluated as a tradeoff between the cash proceeds from the transaction relative to the expected cash generation of REC Solar. The cash flow model shows that REC Solar was expected to generate NOK 72 million in cash from the time of the spin-off until the maturity of the debt. Compared to the certain NOK 500 million from the spin-off transaction, it is evident that giving up the solar unit significantly improved the firm's debt servicing ability.

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To estimate the probability of a cash shortfall, the cash flow model above was run through a Monte-Carlo simulation, with 5,000 simulations. The variability in the model was generated by setting production volume, market prices, and operational costs as random variables fluctuating within a predetermined range. The range of the output volume was determined by the company's maximum capacity and a 10 percent reduction to account for fluctuations in the production volume. The price range was determined by the expected price development at each quarter until Q2 2014.<sup>27</sup> The operational cost range was based on the current cost and the company's guiding. For each quarter, the high end of the cost range was adjusted to incorporate the expected cost reductions.

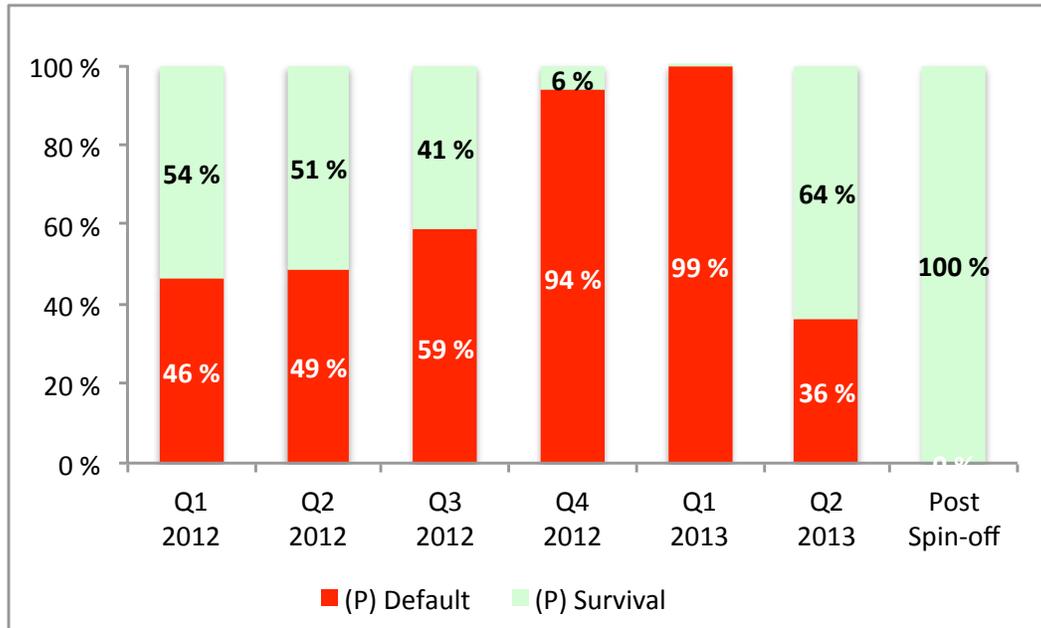
The probability distribution was developed in a frequency table where the required quarterly cash generation, estimated as the spread between the current cash balance and the 2014 maturities divided by the time to maturity, was used as a midpoint. The observations falling below the midpoint were evaluated as in default and observations falling above as survival.

The output of the simulation, presented in Figure 11 below, proves the expected cash flow to equity discount relationship and that the pre spin-off cash shortage risk was 36 percent. This shows that the spin-off eliminated the refinancing risk that the company was subject to, offering further support to the importance of debt in the transaction.

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<sup>27</sup> Simulations typically use a probability distribution for commodities with an observable market price. This was not done in this study because no appropriate probability distribution was found and the short time frame of the study made analyst estimates more representative to the expected price development.

FIGURE 11 OPERATIONAL CASH SHORTAGE FROM MONTE-CARLO SIMULATION



Caption: The graph shows the probability of REC ASA generating sufficient (survival)/insufficient (default) internal cash to meet its debt obligations.

### Probability of default from bond prices

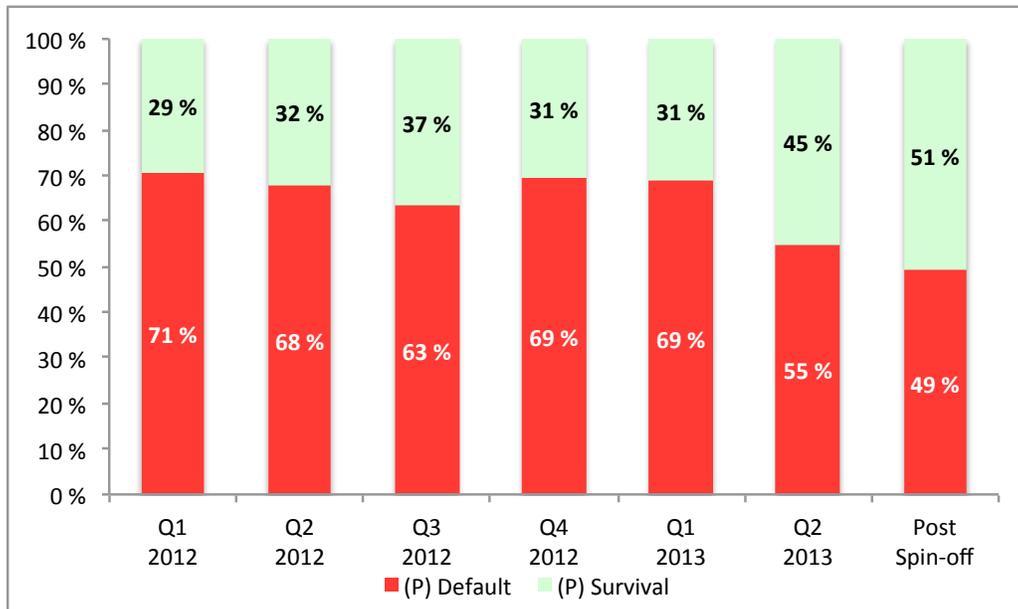
The simulation shows that the probability of a cash shortage in REC ASA was close to 100 percent. However, the model only incorporates cash from internal sources and uses simplifying assumptions. Therefore, to produce a market-based estimate of the bankruptcy risk, the probability of bankruptcy from REC ASA's outstanding debt was calculated.

The bankruptcy risk was calculated by discounting the expected cash flows at the risk free rate and accounting for the lower price through a bankruptcy factor in the numerator. The formula was then solved for the observed market price with the bankruptcy probability as the explaining variable. For a more thorough explanation of the method, please refer to Damodaran (2006).

The default probability presented in Figure 12 below, shows a similar pattern as the output of the simulation model, but the bankruptcy probability fluctuates within a narrower range and the bankruptcy risk experienced in Q1 and Q2 2012 is higher than that experienced during the discount period. The higher initial bankruptcy risk can be linked to the NOK 1.6 billion credit

facility that the company retired following the equity issues during Q3 2012.<sup>28</sup> The default probability also shows that the restructuring in May 2013 and the general improvement in market conditions were more important to the bankruptcy risk than the spin-off.

FIGURE 12 IMPLIED BANKRUPTCY RISK IN REC ASA'S BONDS



Caption: The graph shows the highest cumulative probability of default in REC ASA's straight bonds.

#### 5.4.2 Access to the capital markets

The internal cash generation analysis showed that REC ASA would struggle to retire its debt obligations with cash from operations. To avoid bankruptcy in the event of a short fall, the company would have to seek new capital from investors. This section will therefore evaluate REC ASA's attractiveness in the capital market, by analyzing the participation and market reaction to the restructurings that were pursued prior to the spin-off announcement.

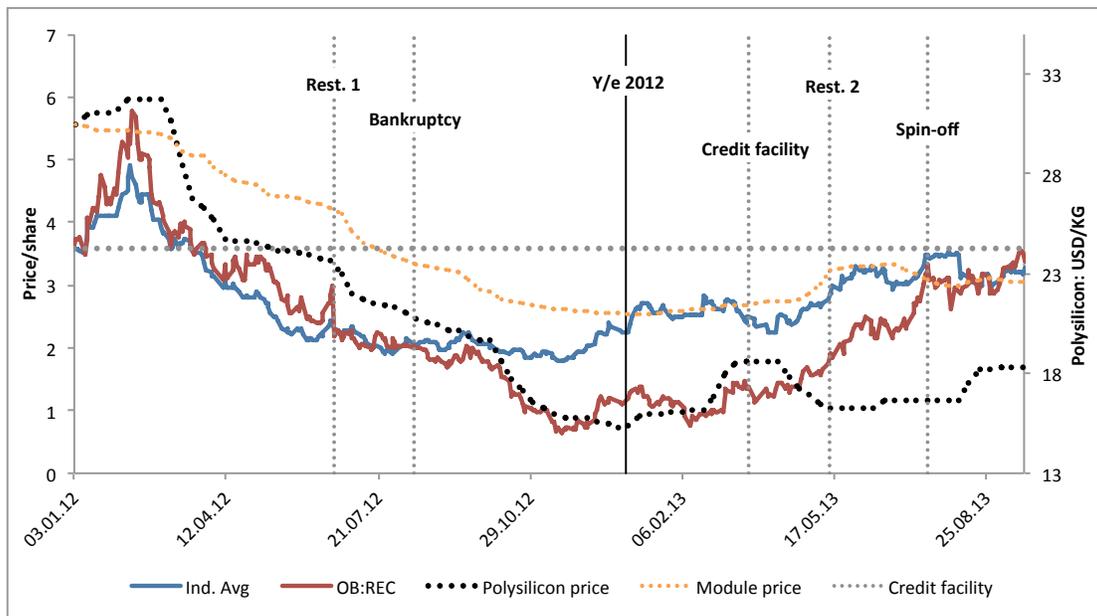
<sup>28</sup> This debt was not included in the simulation.

## Equity market

Equity issues used to retire debt are associated with negative share price return, as it reduces the firm's tax shield and often dilute the ownership of existing shareholders. However, the value of the tax shield is typically limited for firms in financial distress and the reduced bankruptcy risk is found to offset the reduction in the tax shield (Hovakim et. al., 2001). Another aspect of equity issues in financially distressed firms is that they typically have to issue equity at a discount (Julio, 2007). This dilutes the ownership share of existing shareholders and reduces total firm value.

Figure 13 below shows the timing of REC ASAs suggested and completed restructurings. The first (Rest. 1) included the issuance of NOK 1,675 million in equity<sup>29</sup> and a new NOK 2 billion credit facility. The second (Rest. 2) included the issuance of NOK 372 million in new equity and a NOK 426 million tap issue in its longer bonds.<sup>30</sup> The purpose of both issues was to extend the maturity of the firm's debt obligations.

FIGURE 13 PRICE PER SHARE AND OUTPUT PRICES



Caption: Industry average rebased with the share price of REC ASA and module prices rebased with the polysilicon price, as of 04.01.201

<sup>29</sup> The equity issues included a NOK 1,300 million private placement and a NOK 375 million subsequent offering rights issue. The issue increased the equity capital by 112 percent.

<sup>30</sup> The equity issue included a NOK 372 million private placement. The tap issues raised NOK 426 million equally divided between REC02 and REC03.

The suggested restructuring announced in July 2012 (Rest. 1),<sup>31</sup> generated a statistically significant (99%) negative abnormal return in excess of 30 percent. This effect was driven by a dilution effect, as the subscription price in the included equity offerings was at a 23 percent discount relative to the share price at the announcement. Adjusting for the direct dilution effect using the discount adjusted abnormal return<sup>32</sup> (Wruck, 1989) produces a negative abnormal return of negative 13 percent.<sup>33</sup> Both equity issues were oversubscribed.

The completed restructuring (Rest. 2) generated a statistically significant (95%) positive abnormal return of 8 percent on the announcement day, and was followed by a positive share performance leading up to the announcement of the spin-off. The subscription price of the rights issue was at par and the issue was oversubscribed.

The oversubscription in both the secondary offerings suggest that REC ASA had support from equity investors, while the relative pricing in the first restructuring suggests that the access was limited in 2012. However, empirical studies show a positive correlation between the size of a secondary offering and its underpricing, questioning the validity of the underpricing argument (e.g. Corwin, 2003). It can therefore be argued that REC ASA had access to equity capital, but that the size of the necessary refinancing would require it to issue additional shares at a discount. Considering the frequent secondary offerings and the firms cash shortage problems it can therefore be argued that the equity price included a discount due to an expected diluting equity issue and that this discount was eliminated following the spin-off announcement.<sup>34</sup>

### **Credit market**

The secondary offerings discussed above included an adjustment of the company's debt structure. The reaction of bond prices could therefore offer further insight into the market's evaluation of the company's status and the willingness of creditors to accept a restructuring.

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<sup>31</sup> The proceeds from the equity issues were used to retire the NOK 1.6 billion credit facility.

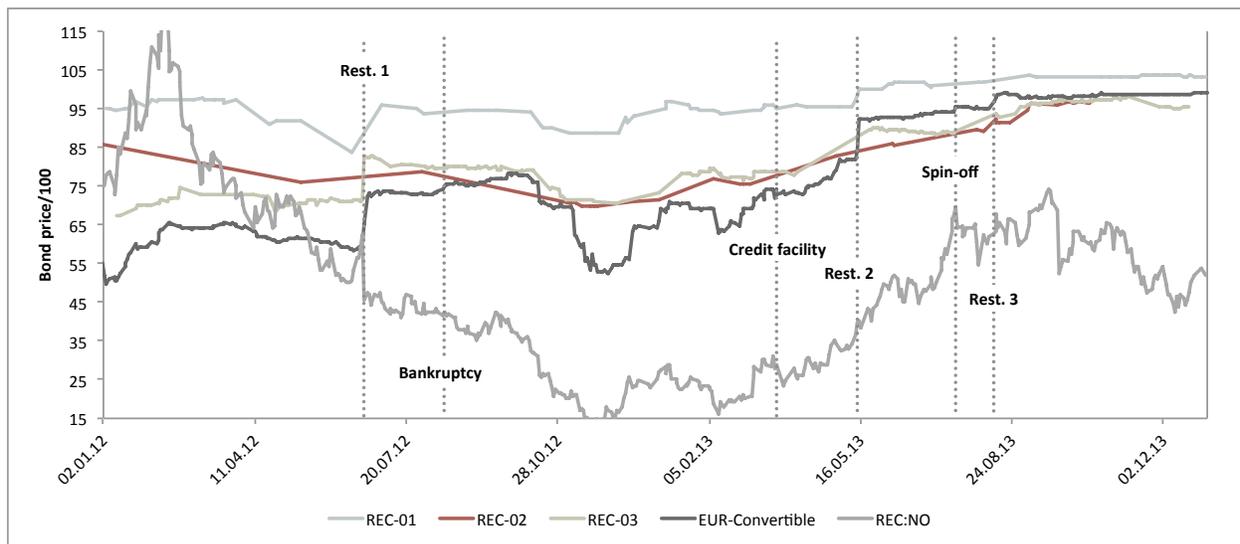
<sup>32</sup>  $AR (adj.)_0 = AR_0 + (issued\ shares/pre-shares) * ((share\ price_0 - subscription\ price)/share\ price_0)$

<sup>33</sup> Abnormal return analysis based on MAC Global Solar Index and an event period running from 23.08.12 to 23.05.12 (191 data points).

<sup>34</sup> The analysis included the estimation of the expected dilution effect but the analysis was too dependent upon its assumptions and was therefore excluded.

The first restructuring (Rest. 1) included a 50 percent reduction of the convertible debt through cash redemption, reduced face value and conversion price, and a new credit facility of NOK 2 billion. However, the deal failed to obtain consent from creditors and only the credit facility and the retirement of an outstanding credit line of NOK 1.6 billion was completed.<sup>35</sup> The NOK 2 billion credit facility was adjusted in Q1 2013, as the company was anticipated to breach its covenants. The adjustment included a reduction to NOK 400 million and an extended no-covenant period. The second restructuring reduced the outstanding debt by 50 percent through cash redemption partially raised from a tap issue in REC ASA's longer bonds.

FIGURE 14 DEVELOPMENTS OF BOND PRICES AND SHARE PRICE



Caption: The chart shows the development in the price of REC ASA's outstanding debt and the share price of REC ASA. The share price has been rebased at NOK 75.

All debt traded on the announcement of the first restructuring show a significant positive reaction, ranging from nine to 16 percent. The positive effect lasted until the polysilicon price reached its threshold, in which prices dropped down towards pre-announcement levels. The market reaction following the alteration to the credit facility was negative two percent, while the price reaction of the second restructuring was positive, with a gain ranging from two percent to 10 percent

<sup>35</sup> No case specific data (e.g. reasons for consent/no-consent) was available from either Norwegian Trustee or the lead underwriter, Arctic Securities, due to strict confidentiality clauses.

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The positive market reaction following the first restructuring and pre-approval from 23 percent of the bondholders suggests that creditors were supportive, even including a loss on face value. However, with a reduced conversion price it is difficult to determine if the loss on face value is the determining factor.<sup>36</sup> In addition, the higher price level was maintained after creditors dismissed the restructuring, suggesting that the positive reaction was caused by the NOK 1.6 billion reduction in the firm's existing credit facilities.

The failure to adhere with covenants and the reduction in the size of the credit line proves that REC ASA's creditworthiness was limited at the beginning of 2013, but the limited reaction to the analysis indicates that it was no surprise to the market.

The second restructuring was a straight pre-redemption at premium prices and does not tell anything about the redeemed creditors willingness to restructure. However, the restructuring was financed by a new issue of debt securities (47 percent) at a fixed coupon rate, which suggests that creditors now were willing to supply additional capital at the pre-discount cost of capital.

The credit market analysis suggests that REC ASA's creditors were unwilling to accept a reduction in face value to help the firm survive and that the challenging industry conditions reduced REC ASA's access to cash from creditors. This condition lasted until the improved market conditions following Q1 2013 allowed the firm to issue new debt securities at pre-crisis debt costs.

This conclusion is supported by the development in the firm's borrowing cost. As presented in Table 10 below, the yield to maturity (YTM) on REC ASA's bonds increased to 18.8 percent in Q4 2012 before declining towards and below the coupon rate in Q2 2013, for REC 03 and REC 01, respectively. Considering that the YTM is a proxy for the firm's borrowing cost, REC ASA's cost of issuing new debt declined towards pre-crisis levels prior to the spin-off announcement. The low YTM suggests that the event specific bankruptcy risk that the company had been trading under was limited at the time of the announcement.

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<sup>36</sup> Value of the warrant at the new conversion price was lower than the reduced face value, but a majority of the convertible debt was held by hedge funds who were speculating in buying cheap debt to gain an equity position in the company.

TABLE 10 YIELD TO MATURITY

	Coupon	Q1 - 2012	Q2 - 2012	Q3 - 2012	Q4 - 2012	Q1 - 2013	Q2 - 2013	Post spin-off
<b>REC 01</b>	11 %	12,3 %	20,8 %	14,3 %	16,0 %	15,1 %	9,8 %	10,0 %
<b>REC 03</b>	9,75 %	16,8 %	18,0 %	15,4 %	18,8 %	16,9 %	12,8 %	13,0 %

Caption: The table shows the development in the YTM for REC 01 and REC 03.<sup>37</sup> The post spin-off YTM is based on the first recorded price following the spin-off announcement.

### Comparing market reactions

Finally, comparing the observed market reaction in the firm's debt and equity securities, displayed in Table 11 below, show that the two first restructurings were more important to creditors, while the spin-off generated more value to equity holders. This is an interesting observation considering that the spin-off eliminated the firm's cash shortage risk. However, this can be seen in connection with the low YTM found in the prior section and supports the argument that equity was trading at a dilution discount.

TABLE 11 PRICE REACTION – EQUITY VS. DEBT

	EURCON		Equity
	t = 0	t = +/- 5	t = 0
<b>Rest. 1</b>	9,1 %	25,4 %	-32 %
<b>Rest. 2</b>	3 %	13 %	8 %
<b>Spin-off</b>	1,55 %	1,49 %	19 %
<b>Rest. 3</b>	1,6 %	4,1 %	1 %

In summary, the external capital analysis shows that REC ASA had access to the capital markets. However, the dilutive equity issues, the failure to meet covenants, and the high YTM suggests that raising new capital would be expensive to the company and its shareholders. Thus, the discount observed in the price could include both a dilution effect and an unfavorable refinancing solution. Finally, the price reaction in the firm's outstanding securities suggest that the first two restructurings were more important to the company's debt servicing ability, while the spin-off increased the upside to the firm's shareholders. This suggests that the longer-term strategic benefits of the separation were important to the value generation.

<sup>37</sup> The other bonds are not included as REC 02 had a NIBOR linked coupon and the YTM of the convertible do not have a representative benchmark.

## 5.5 Value generation in a theoretical framework

The analysis of the firm's internal cash generation and access to the capital markets shows that the spin-off solved REC ASA's cash constraints. In addition, it showed that the gain was concentrated in the firm's equity. The observed post announcement gain could therefore be associated with investment opportunities that became available to REC ASA following the spin-off.

The strand of research on the connection between investment opportunities and equity value presents two opposing theories. The first theory builds on a rational market argument, where the share price is a direct representation of the investment opportunities available to the company (e.g. Morck et al., 1990). Any deviation from this value is explained by market imperfections, such as the debt overhang (Ovtchinnikov and McConnell, 2009). The second theory builds on the idea that markets are irrational and that irrational pricing impact a firm's equity issuance and therefore its investment strategy (e.g. Baker et al., 2003). Based on these theories, the observed gain in REC ASA could be related to either the elimination of a market imperfection or a revaluation that expanded the investment opportunities available to the firm.

Debt overhang refers to a situation where equity investors are reluctant to supply project capital because the proceeds of the project will be used to retire debt. This increases the project hurdle rate and reduces the investment opportunities available to the firm. Considering REC ASA's cash shortage, the discounted value could be associated with a debt overhang. As shown in table 12 below, REC ASA was subject to a debt overhang from Q1 2012 until Q1 2013. However, this was eliminated following improved market conditions and the reduction in outstanding debt during Q2 2013. This shows that the debt overhang had negatively impacted company value but that the associated discount was eliminated prior to the spin-off.

TABLE 12 DEBT OVERHANG

Q1 2012	Q2 2012	Q3 2012	Q4 2012	Q1 2013	Q2 2013
0,20	0,09	0,05	0,14	0,10	0,00

Caption: The debt overhang was calculated using an equity as an option model (see Berk and DeMarzo, 2013)

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In relation to the irrational market theory, the spin-off caused a revaluation of the firm's assets, as it moved the company's value from a relative discount to a relative premium. This implies that the investment opportunities available to the company increased, as it improved its access to capital at fair terms. However, since the value to investment proposition runs in the opposite direction, it cannot be used to explain the observed market reaction.

The theoretical frameworks supports that the improved cash situation in REC ASA positively impacted its value by expanding its investment universe and eliminating market imperfections. However, according to the estimate of debt overhang, improved market conditions and the restructuring pursued in May solved the company's debt overhang problem prior to the spin-off announcement. The theoretical frameworks can therefore not be set in direct connection with the observed gain following the spin-off announcement.

## 5.7 Replicating the observed gains

The event analysis showed that the spin-off in REC ASA generated value by eliminating the firm's dependence on future cash flow for debt retirement. In addition, it showed that a majority of the upside fell to shareholders supporting the strategic benefits of the separation. To replicate the observed gains, this section will use a valuation framework that incorporates the changes generated by the spin-off.

### 5.7.1. Bankruptcy risk as an explanatory factor

This test will estimate how much of the observed announcement return that can be explained by the observed change in the implied bankruptcy risk in REC ASA's bonds. The test will be run in a two-factor valuation model with one going concern scenario and one bankruptcy scenario. The weighting of each scenario will be based on the calculated bankruptcy risk in REC ASA's bonds. For more on this method, see Damodaran (2006).

The going concern value is determined in a valuation model using the market expected price and volume data. The output of the model suggests that a fair no-bankruptcy value at the time of the spin-off was in a range between NOK 4.79 and NOK 5.5. This valuation range is similar to the implied going concern value found using the two-factor model with observed market prices as input data. The average of the two values will therefore be used.

The test will be run using two estimates of the value in a bankruptcy scenario. The first is based on an estimated resale value of the values in REC ASA's balance sheet (see e.g. Graham and Dodd, 2009). The second is based on an estimated replacement value from industry CAPEX data. The estimated, per share liquidation value at the time of the spin-off was NOK 0.15 and NOK 1.89 for the balance sheet method and the replacement method, respectively.

The bankruptcy risk is estimated in REC 03 and the convertible,<sup>38</sup> as these were the bonds that traded around the spin-off announcement.<sup>39</sup> The test includes the bankruptcy estimates from three dates to incorporate the full effect on the firm's bonds, as their price reaction following the spin-off was moderate due to the polysilicon tariff announcement. The test uses the difference between the pre-announcement bankruptcy probability and the bankruptcy probability found in the observations following the spin-off announcement. The estimated bankruptcy risk can be observed in the table below.

TABLE 13 CUMULATIVE PROBABILITY OF DEFAULT

	17.07.13	18.07.13	14.08.13	23.09.13
<b>REC03</b>	54,9 %	54,7 %	50,5 %	47,7 %
<b>EURCON</b>	34,4 %	27,1 %	25,1 %	24,7 %

The output of the test can be observed in Table 13. It shows that the observed change in the bankruptcy risk can explain from 0 to 11 percent of the gain on the announcement day. Based on the later dates, the bankruptcy risk can explain up to 15 percent of the observed gain. However, the later observations are impacted by the debt restructurings offered by the company and are therefore not as representative to the announcement day abnormal return. This shows that regardless of the moderate reaction in the firm's outstanding bonds following the spin-off announcement, it is able to explain a substantial part of the gain in equity value.

<sup>38</sup> Method only applicable to straight bonds, but the warrant was out of the money and the bond therefore traded as straight debt.

<sup>39</sup> The bankruptcy probability was estimated by discounting the bond cashflows at the risk free rate and inserting a bankruptcy factor in the nominator. The formula was then solved for the observed market price. For more on this method, please see Damodaran (2006).

TABLE 14 REPLICATED ANNOUNCEMENT RETURN

	18.07.13	14.08.13	23.09.13		18.07.13	14.08.13	23.09.13
<b>REC03</b>	0 %	9 %	15 %	<b>REC03</b>	0 %	4 %	7 %
<b>EURCON</b>	11 %	14 %	14 %	<b>EURCON</b>	6 %	8 %	8 %

Caption: Left shows the output using the balance sheet based liquidation value and right table the replacement value based on CAPEX data.

## 5.8 Discarded models

The analysis included the development of several models including an equity as an option model, and a two-scenario valuation model. These will be discussed briefly below.

The idea behind the equity as an option model was to replicate the observed market reaction by incorporating the impact the spin-off had on expected equity volatility and average duration. REC ASA's equity was expected to fit well in the option framework due to its high debt levels, the discounted equity value, and its option like price movement.

While the option model was able to describe the equity value at its deepest discount at year-end 2012, the positive price trend at the beginning of 2013 required extreme input assumptions to replicate the equity value in the option model. The model was therefore eliminated from the study. For reference, the replicated announcement day return output tables are presented below.

Abnormal return - Option model - Q2 - Observed volatility						
		Duration				
		0,64	1,50	1,63	2,15	2,5
Volatility	15 %	0 %	0 %	0 %	0 %	0 %
	20 %	0 %	0 %	0 %	0 %	0 %
	25 %	0 %	0 %	0 %	0 %	0 %
	30 %	0 %	0 %	0 %	1 %	1 %
	35 %	0 %	1 %	1 %	2 %	3 %

Abnormal return - Option model - Q2 - Implied Volatility						
		Duration				
		0,64	1,50	1,63	2,15	2,5
Volatility	149 %	0 %	17 %	19 %	26 %	29 %
	154 %	1 %	19 %	21 %	27 %	31 %
	159 %	2 %	20 %	22 %	29 %	32 %
	164 %	3 %	22 %	24 %	30 %	34 %
	169 %	4 %	23 %	25 %	32 %	35 %

The two-factor valuation model was developed to estimate whether the change in the bankruptcy risk was sufficient to explain the observed price reaction in REC ASA. The model included a going concern scenario and a bankruptcy scenario, where the bankruptcy scenario was weighted with the observed bankruptcy probability in the firm's debt securities.

The analysis included three different scenarios. The first tested for an implied upside scenario (going concern) using the liquidation value adjusted for bankruptcy costs as the value in the bankruptcy scenario. The model showed that the going concern value fluctuated too much for the observed bankruptcy risk to be a sufficient explanatory factor.

The second scenario fixed the observed going concern value at the post spin-off level and solved for the bankruptcy risk that was necessary to replicate the observed price development. This showed that the necessary bankruptcy risk was close to 100%. Considering that this level was substantially higher than the one observed in the company's bonds and even exceeded the estimates of the Monte-Carlo model, suggested that the bankruptcy risk and the spin-off impacted the going concern value of the firm.

The third scenario included a valuation of REC ASA's tangible investment opportunities to determine whether their value was sufficient to explain the spread in the going concern value found in scenario 1. The analysis showed that the projects, even using the most positive input factors, were insufficient to explain the spread. The two-factor model was therefore not successful at describing the observed price development in REC ASA and was therefore not included in the study.

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## 6. Conclusion

The announcement of the spin-off of REC Solar ASA generated a statistically significant (99%) intra day abnormal return of 19.53 percent, making it a value generating transaction. The longer post spin-off event windows were negatively impacted by the announcement of a Chinese polysilicon tariff and therefore not directly representative. A positive post-announcement gain was also found in the firm's debt securities, proving that the spin-off generated real economic gains.

The spin-off generated value by satisfying the three main concerns of the company's investors. It solved the firm's cash shortage problem, thereby eliminating the need for additional dilutive secondary offerings and allowing both firm's to pursue their growth opportunities. It eliminated REC Silicon's exposure to the module industry, ending the cross subsidizing of REC Solar and allowing it to take full advantage of its superior industrial position. Finally, it strengthened the balance sheet of REC Solar, positioning it for the expected shakeout stages that the module industry was expected to go through.

The analysis of the value drivers in the transaction show that REC ASA was trading at a relative discount in the period leading up to the spin-off. This discount was directly related to the firm's short debt schedule and a negative trend in the price level in polysilicon that questioned the firm's ability to generate sufficient cash to meet its short debt maturities. Even though improved market prices and reduced cash costs had diminished the risk of a cash shortage prior to the spin-off, the capital that was raised through the spin-off brought the parent company's cash balance in excess of its shorter maturities, thereby eliminating its refinancing risk.

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# Appendix

## Appendix A: Derivation of the homemade index

An index can be derived using four methodologies, a price weighted, an equally weighted, a market-weighted approach, and an average return approach.

### **Price weighted index (e.g. Dow Jones Industrial Average, Nikkei 225)**

A price weighted index sum the value of one share in each company included in the index. The result is an index that weighs the most expensive shares more heavily than the cheaper ones.

While a price weighted index is simple to derive, it has potential weaknesses because the price weighting can distribute the index value unreasonably, as share price is dependent upon both size and number of shares outstanding.

### **Market weighted index**

A market weighted index uses each firm's market capitalization in determining its weighting. This assigns a higher weight to larger firms.

### **Equally weighted index**

An equally weighted index use a rebased stock price where the value of each share is set equal at a given point and then adjusted using a rebasing factor in the period in which the industry is recorded. This gives each individual stock an equal weighting.

### **Average return**

The average return approach takes the average return for all companies included in the index. This provides a measure of the average daily return in the industry and is similar to the equally weighted index in that it is not impacted by the currency value of the shares included in the index.

### **Output data**

Off the different "homemade" indexes, the average return model provided the strongest explanatory ability. The silicon companies included in the index particularly drove this. The other

approaches yielded relatively low explanatory ability ranging from 2.87% to 7.01%. The analysis will therefore be performed using the average return approach. The output of the regression using the different indexes can be found in the table below.

#### OUTPUT DATA HOMEMADE INDEX

	Index - Avg. Return			Rebased	Price weighted	Value weighted
	Cumulative	Silicon	Solar			
<b>R-squared</b>	15,22 %	18,22 %	2,38 %	7,01 %	3,32 %	2,87 %
<b>Intercept</b>	0,00053	-0,00072	0,00182	0,00071	0,00174	0,00071
<b>X-variable</b>	1,32069	1,35353	0,33909	0,49639	0,44019	0,49639

#### Discussion on potential weaknesses of choosing this approach

The average return approach is not used in any public indexes and there is therefore limited literature on the topic. However, from our analysis the average return approach appears to be a proxy of the equally weighted approach, as it solely focuses on the return of the shares.

#### INDEX CHARACTERISTICS

Index Characteristics	
<b># of firms</b>	20
<b>Solar firms</b>	6
<b>Silicon firms</b>	14

The index included a total of 20 firms, with comparable characteristics to REC ASA. While the chart shows that it consisted of six solar firms and 14 silicon firms, the distinction is not as clear, as several of the firms are involved in both industries.

The firms included in the index are listed below:

Ticker	Name	Category
XTRA:WCH	Wacker Chemie AG	Silicon
SEHK:3800	GCL-Poly Energy Holdings LTD	Silicon
TSE:4043	Tokyama Corp	Silicon
OB:REC	REC ASA (REC Silicon)	Silicon
XTRA:SWV	SolarWorld AG	Silicon
NasdaqGS:GTAT	GT Advanced Technologies Inc.	Silicon
NasdaqGS:FSLR	First Solar Inc.	Silicon
NYSE:SUNE	SunEdison Inc.	Silicon
GTSM:5483	Sino-American Silicon Products	Silicon
SEHK:757	SolarGiga Energy Holdings Limited	Silicon
TSE:3436	Sumco Corporation	Silicon
NYSE:DQ	Daqo New Energy Corp	Silicon
LSE:PVCS	PV Crystalox Solar plc	Silicon
OTCPK:LDKS.Y	LDK Solar Co	Silicon
NasdaqCM:RGSE	Real Goods Solar Inc.	Solar
XTRA:CGY	Conergy AG	Solar
KOSE:A110570	Nexolon Co., Ltd.	Solar
OTCPK:WEST	Andalay Solar Inc.	Solar
KOSDAQ:A036930	N/A	N/A
TSEC:2455	Visual Photonics Epitaxy Co., Ltd	Solar

## Appendix B: Output abnormal return in the spin-off period

Abnormal Return - Spin-Off				
Event	Date	Actual Return	Expected Return	Abnormal Return
	Jun-20-2013	-2,30 %	-5,68 %	3,38 %
	Jun-21-2013	0,60 %	2,05 %	-1,45 %
	Jun-24-2013	-10,30 %	-6,18 %	-4,12 %
	Jun-25-2013	3,18 %	-0,44 %	3,62 %
	Jun-26-2013	2,46 %	2,38 %	0,08 %
	Jun-27-2013	1,52 %	-0,43 %	1,95 %
	Jun-28-2013	-1,07 %	0,82 %	-1,89 %
	Jul-01-2013	4,12 %	1,77 %	2,36 %
	Jul-02-2013	3,30 %	-0,91 %	4,21 %
	Jul-03-2013	-5,73 %	-1,61 %	-4,12 %
	Jul-04-2013	0,79 %	0,00 %	0,78 %
	Jul-05-2013	2,42 %	-5,72 %	8,14 %
	Jul-08-2013	5,96 %	-1,66 %	7,62 %
	Jul-09-2013	5,85 %	1,93 %	3,92 %
	Jul-10-2013	-0,84 %	0,05 %	-0,89 %
	Jul-11-2013	4,55 %	1,98 %	2,58 %
	Jul-12-2013	-2,21 %	0,63 %	-2,85 %
	Jul-15-2013	10,21 %	5,97 %	4,24 %
	Jul-16-2013	4,99 %	2,85 %	2,14 %
	Jul-17-2013	1,27 %	-0,22 %	1,50 %
<b>Announcement</b>	Jul-18-2013	19,23 %	-0,30 %	19,53 %
	Jul-19-2013	-24,09 %	0,05 %	-24,14 %
	Jul-22-2013	0,79 %	-1,29 %	2,09 %
<b>Citi report published</b>	Jul-23-2013	-4,86 %	-0,79 %	-4,07 %
	Jul-24-2013	1,03 %	-2,73 %	3,76 %
	Jul-25-2013	3,04 %	1,57 %	1,47 %
	Jul-26-2013	-0,27 %	-0,76 %	0,49 %
	Jul-29-2013	0,33 %	0,40 %	-0,07 %
	Jul-30-2013	1,19 %	0,21 %	0,97 %
	Jul-31-2013	0,07 %	-0,09 %	0,16 %
	Aug-01-2013	-7,13 %	-1,27 %	-5,86 %
	Aug-02-2013	-10,77 %	-0,96 %	-9,81 %
	Aug-05-2013	13,21 %	3,04 %	10,17 %
	Aug-06-2013	-1,73 %	-0,70 %	-1,03 %
	Aug-07-2013	-0,35 %	-6,57 %	6,21 %
	Aug-08-2013	-1,41 %	0,83 %	-2,24 %
	Aug-09-2013	3,36 %	0,37 %	2,99 %
<b>Restructuring announced</b>	Aug-12-2013	1,16 %	0,69 %	0,47 %
<b>Successful bond offering announced</b>	Aug-13-2013	0,68 %	-0,15 %	0,83 %
	Aug-14-2013	6,85 %	-0,04 %	6,89 %
	Aug-15-2013	-5,51 %	-3,78 %	-1,73 %
	Aug-16-2013	2,31 %	0,79 %	1,52 %
	Aug-19-2013	-3,65 %	-1,28 %	-2,36 %
	Aug-20-2013	-4,85 %	-0,73 %	-4,11 %
	Aug-21-2013	3,48 %	0,28 %	3,21 %
	Aug-22-2013	6,18 %	2,58 %	3,60 %
<b>Improved repurchase terms announced</b>	Aug-23-2013	-0,13 %	1,41 %	-1,54 %
	Aug-26-2013	-1,04 %	-1,16 %	0,13 %
<b>Creditor consent</b>	Aug-27-2013	-5,22 %	-3,87 %	-1,35 %
	Aug-28-2013	-4,28 %	-0,69 %	-3,59 %
	Aug-29-2013	2,34 %	2,52 %	-0,18 %
	Aug-30-2013	-1,69 %	0,23 %	-1,92 %
	Sep-02-2013	2,04 %	0,21 %	1,83 %
	Sep-03-2013	3,29 %	1,12 %	2,17 %
	Sep-04-2013	2,79 %	2,05 %	0,75 %
	Sep-05-2013	4,87 %	1,68 %	3,19 %
	Sep-06-2013	0,00 %	0,36 %	-0,36 %
	Sep-09-2013	1,00 %	-0,77 %	1,77 %
	Sep-10-2013	-0,68 %	1,60 %	-2,28 %
	Sep-11-2013	1,05 %	0,61 %	0,44 %
	Sep-12-2013	1,41 %	-1,22 %	2,63 %
	Sep-13-2013	-1,59 %	0,30 %	-1,89 %
	Sep-16-2013	5,76 %	0,40 %	5,36 %
	Sep-17-2013	1,16 %	0,74 %	0,42 %
	Sep-18-2013	-0,58 %	1,93 %	-2,51 %
	Sep-19-2013	-4,14 %	1,42 %	-5,56 %
	Sep-20-2013	0,24 %	2,22 %	-1,98 %
<b>Management approval</b>	Sep-23-2013	0,24 %	1,58 %	-1,34 %

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## Appendix C: Restructurings and corporate actions from 2012-2013

### **April 24, 2012 (Discontinuation of Production)**

The remaining wafer production in Norway is closed down.

### **June 22, 2012 (Unsuccessful Restructuring 1)**

REC ASA announces a refinancing proposal that includes an issue of new shares through a private placement raising gross proceeds of NOK 1300 million with a subsequent repair offering of NOK 375 million and a NOK 2 billion new bank debt facility maturing in May, 2015 (replacing a NOK 4 billion bank debt facility maturing in May 2013). The private placement was offered at NOK 1.50, equivalent to a 23 percent discount relative to the share price on announcement day. In addition REC ASA proposes a partial cash redemption (EUR 100 million) of the total EUR 320 million convertible bond issue maturing in June 2014 at par, with a maturity extension of the remaining nominal amount to June, 2017.

### **July 4, 2012 (Private Placement)**

Convertible bondholders do not approve the proposed changes to the convertible bond. The private placement is completed while the maturity of the NOK 2 billion bank debt facility is changed to May, 2014. The private placement is used to retire NOK 1.6 billion credit facility.

### **August 14, 2012 (Controlled Bankruptcy)**

REC Wafer files for bankruptcy.

### **September 4, 2012 (Subsequent Repair Offering)**

The subsequent repair offering in the amount of NOK 375 million is completed.

### **April 26, 2013 (Bank Loan Restructuring)**

The NOK 2 billion bank debt facility is replaced with a NOK 400 million revolving facility and a new guarantee facility of additional NOK 400 million. The existing covenants are amended to not include any measurements of EBITDA and leverage ratio until the end of 2013.

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**May 24, 2013 (Restructuring 2)**

REC repurchases half (EUR 160 million) of the EUR 320 million convertible bond loan maturing in June 2014 with cash payment of NOK 779 million, financed by NOK 372 million equity issue offered at par and an additional tap issue of NOK 213 million from both REC 02 (maturing in 2016) and REC 03 bonds (maturing in 2018). The total outstanding debt is reduced from NOK 4.2 billion to NOK 3.5 billion while the average time to maturity is increased from 2 years to 2.5 years.

**July 18, 2013 (Spin-off Announcement)**

REC ASA announces the separation of its solar and silicon division, where shares of the new entity called REC Solar will be offered to existing shareholders for a total value of NOK 800 million. A consortium, consisting of shareholders of REC ASA, already guarantees for the deal. These shareholders will take over the unsubscribed share subscriptions. Thus the listing of REC Solar ASA is guaranteed to raise NOK 800 million.

**August 12, 2013 (Restructuring 3)**

REC ASA announce repurchase of another EUR 79 million of the EUR 320 million convertible bond loan (EUR 79 million outstanding) and issue of a USD 110 million convertible bond loan with 6.5 percent coupon, maturing in September, 2018. The buyback is settled partially by cash and by the USD convertible bond. After the restructuring, the company's outstanding debt increases by NOK 0.3 billion to NOK 3.8 billion, while the average time to maturity increases from 2.2 years to 2.8 years.

**September 23, 2013 (Spin-off Approval)**

Shareholders approve the separation. REC Solar ASA will acquire the shares of the solar division from REC ASA for NOK 800 million. The transaction will be financed through a non-tradable right issue to existing shareholders of REC ASA, where 58 shares in REC ASA gives the right to 1 share in the newly created REC Solar ASA to the price of NOK 20. The total number of shares in REC Solar ASA will amount to 40 million (40 million shares \* NOK 20 = NOK 800 million). The current shareholders of REC Solar ASA, REC ASA, will redeem all its shares with completion of the offering, thus REC Solar ASA will be wholly owned by the subscribers of the

offering. REC Solar ASA will have no interest-bearing debt after the transaction, as all debt will be held in REC ASA. REC Solar ASA will keep a pro-forma net cash position of NOK 300 million from the offering while NOK 500 million will be transferred to REC ASA as payment for the solar division. REC Solar ASA will be listed on the Oslo Stock Exchange October 25, 2013.

**October 21, 2013 (Debt Repurchase)**

REC Silicon ASA announces a partial repurchases part of its outstanding senior bonds (up to 100 percent of REC01 and 67 percent of REC 02 and REC 03). The deal is completed November 5, 2013 and includes a 70 percent buy-back of REC01 offered at 103 percent of par value, and 67 percent buy back of REC02 and REC03 offered at par. The company's outstanding debt is reduced from NOK 3.8 billion in Q3 2013 to NOK 2.8 billion, while the average time to maturity is reduced from 2.8 years in Q3 to 1.7 years.

**October 25, 2013 (Spin-off Day)**

REC Solar ASA is listed on the Oslo Stock Exchange under symbol RECSOL. The closing value of the first day of trading is NOK 2.5 billion. REC ASA is renamed REC Silicon ASA and continues to trade under symbol REC.