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Measuring competitive advantage with an asset-light valuation model

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Defining competitive advantage as the ability of a firm to generate returns in excess of its synthetic normal returns; the present study develops an “asset-light” valuation model to capture intangible strategic resources, that do not appear on balance sheets and could explain abnormal returns. Three propositions are derived from the model: (1) firms emphasizing light assets over tangible assets, generate superior performance; (2) at a given level of synthetic normal returns, firms possessing more “light” assets have superior performance; and (3) to achieve a given book rate of return, firms with more light assets require fewer tangible assets as inputs. An empirical study of the global semiconductor industry significantly supports all three propositions. The results show that, the excess returns observed across an industry reflect heterogeneity in the “light assets” possessed by the firms, and provide an explanation for observed differences in performance.

Key words: Competitive advantage, asset-light valuation, semiconductor industry.

INTRODUCTION

Mainstream research into strategic management suggests that intra-industry performance differences can be attributed to “competitive advantage” (Porter, 1980, 1985; Ghemawat, 1986; Barney, 1991; Amit and Schoemaker, 1993). Competitive advantage is defined as an intrinsic property of firms that creates value (Porter, 1985; Kay, 1993; Brandenburgr and Stuart, 1996), either by generating greater-than-expected returns from available resources (Peteraf, 1993; Barney, 2002) or by allowing a firm to outperform its rivals on certain behavioral measures (Porter, 1985; Ghemawat et al., 1999; Saloner et al., 2001; Hunt, 2002). Both viewpoints formally define competitive advantage as excess value relative to the firm’s internal opportunity cost or a benchmark in the industry. The excess value due to competitive advantage can be expressed as above-normal performance, profits or economic rent (Barney, 1991; Conner, 1991), but must be sustained over a long period of time (Wiggins and Ruefli, 2002).

The resource-based view (RBV) specifies that resources are important antecedents to a firm’s overall performance (Wernerfelt, 1984; Barney, 1991) as well as sources of sustained competitive heterogeneity among firms (Hoopes et al., 2003). RBV-based studies have identified a wide range of strategic resources, including physical capital (Williamson, 1975), human capital (Becker, 1964), technological opportunities and learning (Teece, 1980, 1982, 1986), organizational capital (Tomer, 1987), organizational culture (Barney, 1986) and market-based assets (Srivastava et al., 2001). Most of these resources are usually considered intangible assets. Thus, “abnormal profits, dominant competitive positions and sometimes even temporary monopolies are achieved by the sound deployment of intangibles, along with other types of assets” (Lev, 2001) is a fair statement of the RBV. If a firm’s assets include any resource that can increase the net cash inflow by increasing revenues and/or decreasing costs (Damodaran, 2001), then the positive earnings generated by strategic resources can be considered accounting assets. However, intangible resources are not usually valued in accounting books, being considered non-market goods. Thus, any excess returns not attributable to balance sheet items can be treated as the...
specific contribution from intangible strategic resources.

From a probabilistic viewpoint, firms having achieved superior performance are more likely to possess sustained competitive advantage (Powell, 2001, 2002, 2003; Tang and Liou, 2010). For example, this relationship is assumed when applying the book return (book return on equity) model, to detect the presence or absence of competitive advantage (Hunt, 2002; Grant, 2008; Tang and Liou, 2010). Under such a definition, the excess value generated by competitive advantage is obtained by subtracting the “normal” book returns from a particular firm’s book returns.

In the present study, “normal” returns exclude the costs of off-balance-sheet intangible assets. The study presumes that, if a firm has competitive advantage, its book returns will be greater than its “normal” returns. In other words, the excess returns will be positive. The study have developed a valuation model to model the competitive advantage of firms in terms of their intangible resources or “light assets”. The terms “asset-light” and “asset lightness” describe the relative importance of intangible strategic resources and tangible assets to a firm.

An asset-light business model is a corporate strategy that pursues capital efficiency by focusing equity investment on a company’s expertise (that is core intangible resources and capabilities) which obtain the best returns for investors (Maly and Palter, 2002). After developing a valuation model for asset lightness, this paper states three propositions concerning the features of asset-light strategies. In the empirical portion of this study, we test these propositions on data from the global semiconductor industry, an area where strategic intangible resources are considered essential to performance.

THE VALUATION OF FIRMS AND COMPETITIVE ADVANTAGE

Causality between competitive advantage and financial performance

The RBV framework has proven to be of great value to strategic management and marketing researchers investigating the sources of sustainable competitive advantage and organizational survival (Kraatz and Zajac, 2001; Srivastava et al., 2001; Adner and Zemsky, 2006). Despite its rapid diffusion through the literature, however, the RBV has been challenged as a tautological theory. In particular, it is unclear how one might test its central claim: “sustainable advantage generates superior performance” (Priem and Butler, 2001).

To resolve the tautological fallacy of the RBV, Powell (2001; 2002; 2003) suggested a Bayesian epistemological approach. His strategy was to rephrase the deterministic, unidirectional proposition as a probabilistic inference: “sustainable competitive advantage is more probable in firms that have already achieved sustained superior performance.” That is, the plausibility of competitive advantage is conditional upon evidence of superior performance. Tang and Liou (2010) generalized Powell’s probabilistic inference as an antecedent of resource bundle configurations and dynamic learning capabilities. They postulated that while these properties of a firm generally cannot be comprehended by outsiders, superior performance can be captured by financial indicators such as operating revenue, market share and stock prices. According to this inductive framework, the presence or absence of competitive advantage entails causation among resource configuration, dynamic learning capability and superior financial performance. The same framework can be applied to infer the relationships among corporate strategy, competitive advantage and firm value. That is, the study can assume that a firm’s value includes an outcome revealing the possible competitive advantage brought about by its corporate strategy.

Defining competitive advantage as abnormal returns

Neoclassical economic theory holds that no firm can earn abnormal profits (that is, economic rents) in a perfect market in the long run. Of course, this argument relies on the assumption that, the product and factor markets are both perfect. As represented by Porter (1985), the structure-conduct-performance (SCP) theory follows the neoclassical assumption that, firms are homogeneous in terms of management capability, but attributes variations of performance to differences in industrial structures and strategic groups. The SCP asserts that firms are able to earn economic rents because industry heterogeneity emerges as a result of collusive behavior (that is a strategic group) and entry barriers (Porter, 1985). The RBV departs from neoclassical economics and the SCP theory by defining competitive advantage as the fact of having “abnormal profits” (Peteraf, 1993) or “above-average returns” (Schoemaker, 1990) attributable to firm-specific features (Silverman, 2001).

Conceiving the firm as a bundle of resources and capabilities (Silverman, 2001), the RBV asserts that firms are heterogeneous because the market is imperfect with respect to strategic factors (Penrose, 1959). This imperfection or the scarcity of strategic resources, explains the fact that some firms outperform others and enjoy abnormal returns (Peteraf, 1993). A particular firm’s abnormal returns may result from superior productive factors or capabilities (Ricardian rents), or market power in the form of spatial competition or product differentiation (monopoly rents). In addition, abnormal returns may result from joining a collusive strategy, the existence of entry barriers (oligopolistic rents) or super-productivity in bilateral monopolies (Pareto rents and Quasi-rents) (Peteraf, 1993).
The valuation of competitive advantage

The RBV suggests that resource bundles and managing capability are responsible for a firm's competitive advantage or disadvantage. Over the last decade, more than thirty models have been proposed to measure intangible asset resources. These models are based on one of four observables: market capitalization, return on assets, direct intellectual capital, or a scorecard. While the direct intellectual capital and scorecard models are non-valuation, the market capitalization and return on assets methods both attempt to estimate the real financial value of intangibles in currency units. The market capitalization method suggests that, when markets pay a price premium in excess of the firm's book value, a substantial portion of the value must be acquired from intangible assets (Rappaport, 1986; Simon and Sullivan, 1993; Capraro and Srivastava, 1997; Steward, 1997). These intangible assets are "advantage resources" related to the firm's organizational structure.

Therefore, a high market-to-book ratio indicates that a large percentage of the firm's market value consists of advantage resources. For example, Tobin's q indicator is calculated as a firm's market value divided by the replacement cost of its total assets (Tobin, 1969). If Tobin's q is greater than 1, then the company has some competitive advantages that can result in higher-than-average returns on its investments. Return on assets (ROA) represents an opportunity cost and essentially measures how efficiently the firm uses its assets.

If a large proportion of assets are invested in intangibles as opposed to fixed assets, then large values of ROA (the profit per dollar of fixed assets) indicate a less asset-intensive or "lighter" business. Kennon (2005) suggests that, a firm with ROA below 5% is very asset-heavy, while one with ROA above 20% is asset-light. The calculated intangible value (CIV) is a variant of the ROA that applies the "advantage resources" concept. There are two CIV approaches in the literature: the "capitalization of earnings" model and the "excess earnings ROA over reasonable rate" (or over treasury) model. The latter measures intangibles as a premium value over the tangibles (Sapperstein, 2000).

Another common approach is discounted cash flow (DCF) valuation, one of the market capitalization methods. Its theoretical basis is that, the total value of a firm is determined by the present value of its projected future earnings plus the present value of the terminal value. As a measure of future earnings, the DCF approach can be used to evaluate intangible assets such as brand equity, consumer loyalty, the effective life of a patent and customer relationships (Rust et al., 1995). The market capitalization approach and the DCF model estimates the firm's total value, but do not identify which portion is generated from tangible assets (the normal return) and which portion from intangible/strategic resources (the excess return). However, the ROA approach provides a basis for estimating the value of the excess returns, if the normal rate of return is known.

The light asset valuation model

The abnormal return, or economic rent, is the excess return obtained by the firm above the opportunity cost of the resources employed. Commonly used indicators for competitive advantage include return on invested capital and return on equity (ROE) (Grant, 2008; Tang and Liou, 2010). More generally, competitive advantage can be calculated as a net output (for example net income, net operating profits less adjusted tax, or some other measure of profits) divided by the book value of the inputs (for example capital employed, invested capital, or owner's equity).

In a competitive market, the revenues obtained by the firm are a lower bound on the value perceived by its customers. Thus, the market value provides a measurement of the outputs. However, the book value usually fails to capture many firm resources under generally accepted accounting principles. Consequently, the inputs that a firm uses to generate revenue are also underestimated. For example, empirical studies have demonstrated that the economic benefits of advertising expenditures last longer than one year (Hirschey, 1982; Hirschey and Weygandt, 1985; Chauvin and Hischey, 1993). Other studies have concluded that advertising and research and development spending have sustained positive effects on the firm value (Doukas and Switzer, 1992; Chauvin and Hirschey, 1993; Szewczyk et al., 1996; Abrahams and Sidhu, 1998; Chan et al., 2001; Eberhart et al., 2004).

Analogously, spending on market-based assets and human resources affects the firm value over a whole year, although they are accounted as one-time expenses. These intangible resources have been individually recognized as crucial subsets of competitive advantage but are not properly included among a firm's assets (Collins et al., 1997; Lev and Zarowin, 1999). If these off-balance sheet items are incorporated into the firm's total assets, the opportunity cost becomes higher than the assets on the book. Thus, the normal rate of return would be lower than the book rate of return.

The present study uses return on invested capital (ROIC) as the book rate of return. The ROIC is an important measure of earnings efficiency, and represents management's ability to advance and sustain shareholder value (Cao et al., 2006). This profitability measure can indicate the presence or absence of competitive advantage in firms (Tang and Liou, 2010). The ROIC is calculated as the net operating profit less adjusted taxes (NOPLAT) divided by the invested capital (IC):

$$\text{ROIC} = \frac{\text{NOPLAT}}{\text{IC}}$$  \hspace{1cm} (1)
NOPLAT = EBIT \times (1 - t) + \text{deferred income tax (if it exists)}

IC = \text{Net fixed assets} + \text{net working capital} + \text{other assets} = \text{Assets} - \text{non-interest bearing short-term liabilities}

The weighted average cost of capital (WACC) represents the opportunity cost of all resources deployed for generating future returns. Firms with a ROIC greater than the WACC are characterized as well-performing, while others are considered to be poor performers. If the market is admissibly efficient, the WACC intuitively reflects the risk associated with the funding resources. Therefore, if the product and factor markets were perfectly competitive, the firm could only generate a return to cover its opportunity cost: the WACC plus the risk-free return. Excess returns are defined as the ROIC minus the WACC and minus the risk-free return (that is \(\text{ROIC} - \text{WACC} - r\)). If excess returns persist, they can be attributed to the off-balance sheet, intangible assets of the firm. Excess returns are the net benefit created by unique resources and capabilities that the firm has accumulated from its previous investments. Hereafter, the study calls these intangible resources and capabilities “light assets”, distinguishing them from the firm’s tangible or “heavy” assets. Thus, excess returns observed across an industry reflect heterogeneity in the “light assets” possessed by the firms, and provide an explanation for observed differences in performance.

A firm can either deposit its money to receive a risk-free interest rate \(r\), or it can invest its money in heavy and light assets to earn a ROIC. This ROIC (the output) must be greater than the input cost plus the risk-free rate. Moreover, assuming that the firm has an infinite lifespan and benefits from a fixed annual rate of return, the estimated value of excess returns on heavy and light assets should not be less than the total book value of the corresponding fixed annual deposits. That is,

\[
\frac{\text{ICA}}{\text{(ROIC} - \text{WACC})} \geq \frac{\text{ICB}}{r}
\]

(2)

Where, ICA and ICB represent the real value and book value of the deployed assets respectively.

The WACC is the minimum return that a firm must earn on existing invested capital. The WACC can be calculated by taking into account the proportionate weights of various funding sources such as common equity, straight debt, warrants and stock options, and multiplying them by the cost of each capital component:

\[
\text{WACC} = \frac{D}{D + E} \times R_d \times (1 - t) + \frac{E}{D + E} \times R_e
\]

(3)

Where, \(R_d\) = cost of debt, \(R_e\) = cost of equity, \(D\) = debt, and \(E\) = equity.

By rearranging Equation 2 on a risk-free rate of return, we can obtain the real value of the invested capital. We have:

\[
\text{ICA} \geq \left(\frac{\text{ROIC} - \text{WACC}}{r}\right) \times \text{ICB}
\]

(4)

which becomes

\[
\text{ICA} \geq \frac{1}{r} \times \text{ICB} \times (\text{ROIC} - \text{WACC})
\]

(5)

The lower limit is

\[
\text{ICA} - \text{ICB} \geq \frac{1}{r} \times \text{ICB} \times (\text{ROIC} - \text{WACC}) - \text{ICB}
\]

(6)

Equations 4 and 5 reveal an important relationship: the greater the excess return over the risk-free rate (that is \(\text{ROIC} - \text{WACC} - r\)), the greater the real value of the invested capital. Since we defined the total value of light assets as the difference between the real value of the firm and the book value of the firm, the excess benefit \((\text{ICA} - \text{ICB})\) is the value of the light assets. As a result, Equation 6 can be re-written as an off-balance-sheet “light asset valuation model”:

\[
\text{LA} = \text{ICA} - \text{ICB} - \frac{\text{ICB} \times (\text{ROIC} - \text{WACC} - r)}{r}
\]

(7)

\(\text{LA}\) denotes the value of the light assets, and \((\text{ROIC} - \text{WACC} - r)\) is the excess return or equivalently the rate of return on light assets (ROLA). If we add goodwill (GW) and intangibles (IA) to the balance sheet value, we obtain

\[
\text{LA} = \frac{1}{r} \times \text{ICB} \times (\text{ROIC} - \text{WACC} - r) + \text{GW} + \text{IA}
\]

(8)

The item \((\text{ROIC} - \text{WACC})\) in Equation 8 can be re-stated as the net operating profit less adjusted taxes minus the operating cost, divided by the invested capital; \((\text{NOPLAT} - \text{WACC} \times \text{IC}) / \text{IC}\). Note that \((\text{NOPLAT} - \text{WACC} \times \text{IC})\) is exactly the economic value added (EVA) of the firm. Thus, the light asset valuation model just derived is consistent with the concept of economic value added.

**PROPOSITIONS AND EMPIRICAL ANALYSES**

**Developing propositions**

The book rate of return (BR) may include as the ROIC or ROE, and can be calculated as the book profits divided by the book value of assets. The book value of assets is the same as the invested capital (IC), which only includes tangible assets, goodwill, and intangibles mentioned on
the balance sheet (IC = ICB + GW + IA). It excludes the value of unique resources and capabilities accumulated during the firm's past operations (the value of off-balance-sheet light assets) that continue to contribute to net profits. The study reiterates this important point: in this context, light assets mean those off-balance-sheet assets that infallibly generate net profits for the firm.

Consider a “synthetic” definition of total assets that includes both physical assets on the balance sheet (ICB) and light assets (LA). The rate of return on this synthetic measure would be the intrinsic return (hereafter called the shadow return) on all assets on the balance sheet. The shadow return (SR) is a proxy of the “normal” return. It is calculated as follows:

\[
SR = \frac{NOPLAT}{ICB+LA}
\]  

(9)

Since ROIC = NOPLAT / IC and IC = ICB, if LA > 0 then (ICB+LA) is greater than IC (= ICB + GW + IA). Thus, if LA>0 the ROIC is higher than the SR. On the other hand, if LA < 0 then (ICB+LA) is less than IC and the ROIC is lower than the SR. Since competitive advantage is defined as having abnormal returns, the return on the competitive advantage (CA) is measured as the difference between the book rate of return (BR) and the shadow rate of return (SR). This difference is just the excess return (ROIC – SR), which can now be expressed as follows:

\[
CA = ROIC – SR = \frac{NOPLAT}{IC} – \frac{NOPLAT}{ICB+LA} = NOPLAT \left( \frac{ICB+LA}{IC} \right) \frac{1}{ICB+LA} = ROIC \left( \frac{ICB+LA – IC}{ICB+LA} \right)
\]

Assume that IC = ICB, meaning that goodwill and the intangibles on the balance sheet are negligible. Then the study can rewrite the above equation as follows:

\[
CA = ROIC – SR = ROIC \left( \frac{LA}{ICB+LA} \right)
\]

Dividing Equation 10 by ROIC, the study derives the relationship between light assets, ROIC, and the SR:

\[
1 - \frac{SR}{ROIC} = \frac{LA}{ICB+LA} \Rightarrow \frac{SR}{ROIC} = 1 - \frac{LA}{ICB+LA} = \frac{ICB}{ICB+LA}
\]

\[\Rightarrow \frac{ROIC}{SR} = \frac{ICB+LA}{ICB} \]

Equation 11 illustrates that the ratio of light assets to tangible assets (the degree of “asset lightness”) is positively related to ROIC. Thus, the study suggests the following propositions:

Proposition 1: At a fixed shadow rate of return, firms that are more “asset-light” tend to have stronger competitive advantages.

The study now rewrites Equation 11 as Equations 12 and 13, to generate two more propositions.

\[\Rightarrow \frac{ROIC}{SR} = 1 + \frac{LA}{ICB} \times SR \]  

(11)

\[\Rightarrow \frac{ROIC}{SR} = 1 + \frac{LA}{ICB} \times SR \]  

(11)

\[\Rightarrow \frac{SR}{ROIC} = \frac{NOPLAT}{ICB+LA} \]  

(12)

\[\Rightarrow \frac{ICB}{SR} = \frac{NOPLAT}{SR} – LA \]  

(13)

Proposition 2: Given the same shadow rate of return and the same amount of tangible assets, firms with more light assets tend to have greater net profits.

Proposition 3: Given the same net profit and the same shadow rate of return, firms with more light assets tend to require fewer tangible asset inputs.

The sample data

Many semiconductor manufacturing companies have considered asset-light strategies to cope with rising costs and fierce price competition. For example, Texas Instruments and Philips (NXP Semiconductors) have given up developing new processes for creating digital chips, although both companies still run factories based on older analog technology. To take another example, AMD spun off its manufacturing facilities to create a new company (Global Foundries) so that it could focus on chip design. These and other design companies have given up owning their own plants; they rely on foundries that excel in chip manufacturing services. Here, the study applies the light asset valuation model to the worldwide...
companies from the dataset due to missing/insufficient data or a negative WACC value, which is hard to explain under the assumption of market efficiency (Damodaran, 2001). The resulting dataset contains 115 firms. Twenty-nine are based in Asia/Pacific developing countries (most in Taiwan or Korea). The other 86 are located in developed countries (most in the US, Europe, or Japan).

In deriving Equation 7, the study used the ROIC to find a mathematical relationship between the value of light assets and competitive advantage. In this empirical study, the study use Tobin’s q as a proxy for the competitive advantage of firms and the dependent variable in the regression. Tobin’s q is defined as the ratio of the market value of a firm’s assets to the replacement cost of the firm’s assets (Tobin, 1969). This ratio is an indicator of a firm’s long-term performance: competitive advantage is sustained in a firm that consistently has a high q-ratio relative to its competitors over a long period. The study calculates Tobin’s q for each sample firm using COMPSTAT data, following the procedure laid out in Lang and Stulz (1994) and McGahan (1999). The result is very close to the market-to-book ratio, which in fact explains at least 96.6% of the variability in Tobin’s q (Chung and Pruitt, 1994; Varaiya et al., 1987). In addition, the study computes the economic value added (EVA) and sum non-intangible assets as proxies for the profits and the tangible assets respectively.

The descriptive statistics in Table 1 illustrate the diversity of this industry in terms of scale and profitability. The firms’ ICB values range from US$19 million (Advanced Photonix Inc., USA) to US$43,685 million (Intel, USA). Tobin’s q ranges from 0.07 (Azego AG, Germany) to 6.52 (Sigma Designs Inc., USA), and the EVA ranges from −7.16 (Micron Technology Inc., USA) to 37.93 (Intel, USA). The value of light assets in US$ ranged from –37,342 million (Infineon Technologies, Germany) to 121,333 million (Intel, USA). Table 2 ranks the top ten semiconductor firms by degree of “asset lightness”, also reporting their average ROIC, Tobin’s q, value of light assets, and value of tangible assets during the sample period. Three of the top ten companies were based in Taiwan, a fact that reveals Taiwan’s competitive advantage in the semiconductor foundry industry.

**EMPIRICAL RESULTS**
Table 3 presents regression models for testing our three propositions. All monetary variables, including light assets (LA), EVA, and non-intangible total assets (NITA), were normalized to the unit scale of other regression variables. Sales, sales growth and financial ratios relating to competitive advantage (as shown in previous research; Tang and Liou, 2010) are included in Model 1 as control variables. The results are listed in Table 4.

Model 1 (R-squared = 0.67) reveals that the “asset-light” property is positively related to Tobin’s q (0.123), a result that supports Proposition 1. Model 2 (R-squared = 0.992) controls for the shadow rate of return (coefficient −0.004) the value of tangible assets (1.033), and the value of light assets. Light assets are positively (3.220) related to EVA, supporting Proposition 2. Model 3 (R-squared = 0.98) indicates that after controlling for the net profit (7.366) and the shadow rate of return (−0.347), the values of light assets and tangible asset inputs are negatively correlated (−3.758). In other words, a firm possessing more light assets requires fewer tangible assets to achieve the same profit and shadow rate of return (Proposition 3).

CONCLUSIONS AND SUGGESTIONS
In accordance with the RBV, the present study attributes competitive advantage to the heterogeneous resources and capabilities of firms within the same industry. Although unique resources and capabilities contribute to the net profits of the firm, they are excluded from the balance sheet. The study developed a light asset valuation method to evaluate these factors contributing to competitive advantage. This model is based on the definition of competitive advantage as a quality bringing abnormal returns to the firm.

Specific propositions were derived from the light asset valuation model describing three relationships: (1) between a firm’s emphasis on light assets and the book rate of return, (2) between the value of light assets and profits, and (3) between the value of light assets and the value of tangible assets. The study tested these propositions by analyzing a three-year sample of economic data from the global semiconductor industry. The empirical results support all three propositions, implying that asset-light strategies are an effective way for firms to generate higher returns with fewer invested tangible assets.

The study has verified that the light asset valuation model is useful for measuring the competitive advantage of a firm. One limitation of the present study is its reliance on a cross-sectional empirical analysis. As competitive advantage is presumably dynamic, the study recommends further research to examine whether asset-light companies are consistently superior to asset-heavy companies in a changing economic environment. Another limitation of this study is its focus on manufacturing firms, which by their very nature rely heavily on tangible assets. In future research will apply the valuation model to a service industry where firms have fewer tangible assets.

Finally, the proposed model evaluates competitive advantage in firms that have already achieved superior performance. Some adjustments to the model are required if the study wishes to examine the competitive advantage of start-up firms that have not yet achieved positive profits.

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