I. Intangible Assets as Residual Profit

In this book, we use the term “residual profit” to describe the returns to sunk intangible asset investments. As noted in Chapter 1, the adjective “residual” is used to denote profit that is “left over,” or secondary in its claim to the firm’s operating profit – after physical assets and other forms of “routine” capital have been remunerated. Thus, at a high level, residual profit is defined as the returns to non-routine intangible assets, after routine invested capital has taken its “first claim” over operating profit.

The reader will note that we have just introduced two new, as yet undefined, terms in our definition of residual profit: namely, routine and non-routine. The term “routine” is roughly synonymous with “competitive” or “not a barrier to entry.” Routine assets and activities are those that do not create a barrier to entry, and thus earn a competitive return, or normal profits, over the long run. Correspondingly, non-routine assets and activities are those that are intended to create a competitive advantage, or monopoly power, over some foreseeable time horizon.

Importantly, routine assets may include certain “routine intangibles” such as standard operating procedures, manuals, processes, and the like that are necessary for the firm to maintain its existence in a competitive market. In other words, routine assets, or routine invested capital, may be both tangible and intangible, but its intangible component is always very general in nature, has often leaked into the public domain, and does not in any way result in monopoly power for the firm.

By contrast, a firm invests in non-routine intangible assets in an attempt to earn at least a required rate of return on its intangible asset investments. That is, firms invest in intangible assets in the hope of earning economic profit. Therefore, in a steady state equilibrium, or stylized economic model of the world such as the one that we focus on in this book, intangible asset investments either do generate economic profit, or they just barely earn back their “principal” (upfront investments) plus a required rate of return (the “interest” on that principal).
These two equilibrium results (earning economic profit versus barely covering principal and interest) correspond directly to microeconomic theory. In the first case, we have monopoly power, and corresponding economic profit, resulting from a firm’s intangible asset investments.

Correspondingly, in the latter case, we have what economists call “monopolistic competition.” This is a situation wherein firms compete to gain market power by investing in intangible assets, but competition with other firms means that the pricing premia (or production cost savings) that result from intangible asset investments are competed down to the point that firms just earn enough “extra” profit to repay their sunk intangible asset investments with interest.

Thus, under our definition, residual profit is always the result of monopoly power, classically defined. And, to reiterate, sometimes this monopoly power does not result in economic profit (monopolistic competition), and sometimes it does (true monopoly or oligopoly power that yields residual profit in excess of a required return to intangible asset investments).

As discussed in Chapter 1, this monopoly power can take effect in two primary ways. First, a firm’s monopoly power can take the form of a downward sloping demand curve. For example, the firm may have pricing power that results from its having differentiated products, or a patent-protected position relative to actual or potential competitors. Second, the firm may have a protectable cost advantage over its competitors. That is, the firm may have a privileged cost structure that results from better production technology, superior access to a production input, or some other reason.

It is interesting to note that high profile investors use exactly this kind of thinking when examining the intrinsic value of a company (i.e., the present value of the profit stream that a company will generate). Warren Buffett, for example, talks famously in his annual letters about a firm’s “franchise,” which he basically defines as the period of time, given the firms’ sunk investments in intangible assets, that the firm is expected to generate excess earnings. An excerpt from his

---

1 We recognize that, strictly speaking, monopoly power is the power to price products above fully-loaded costs. However, we use the term monopoly power to encompass lower production costs for the obvious reason that the firm must have a unique ability, relative to competitors, to decrease its costs. It must have a “monopoly” over some kind of low cost technology or input source. Moreover, low costs and pricing power are often very closely related, since low cost providers can generally gain market share, thus enhancing their pricing power as well.
letter of 1991, explaining his distinction between “franchises” and “businesses” (in our parlance, “non-routine assets” versus “routine assets”), is given below.

The fact is that newspaper, television, and magazine properties have begun to resemble businesses more than franchises in their economic behavior. Let’s take a quick look at the characteristics of these two classes of enterprise. … An economic franchise arises from a product or service that: (1) is needed or desired; (2) is thought by its customers to have no close substitute; and (3) is not subject to price regulation. The existence of all three conditions will be demonstrated by a company’s ability to regularly price its product or service aggressively and thereby to earn high rates of return on capital. Moreover, franchises can tolerate mis-management. Inept managers may diminish a franchise’s profitability, but they cannot inflict mortal damage.

In contrast, “a business” earns exceptional profits only if it is the low-cost operator or if supply of its product or service is tight. Tightness in supply usually does not last long. With superior management, a business may maintain its status as a low-cost operator for a much longer time, but even then unceasingly faces the possibility of competitive attack. And a business, unlike a franchise, can be killed by poor management.

In short, Buffett is saying that he looks for firms that are not “businesses” (routine). He looks for companies with intangible assets that allow them to price at a premium, thereby earning economic profit, for an extended period of time. Interestingly, he views low cost production as easily competed away.

A fundamentally similar framework is developed in a famous paper by Miller and Modigliani (both Nobel prize winners in economics). As we discuss in some detail in later chapters, Miller and Modigliani demonstrate that the firm can be valued by summing the discounted present value of its expected flow of normal profit, and the discounted present value of its expected flow of residual profit over a period of time that they call “value growth duration.” Value growth duration is the period of time over which a firm’s competitive advantage – its ability to earn returns on invested capital greater than its cost of capital – is expected to persist. Value growth duration was later dubbed “competitive
advantage period,” or “CAP,” by economists such as Mauboussin, Rappaport, and others.²

Exhibit 2-1 is taken from a research paper published in 1997 by economists Michael Mauboussin and Paul Johnson, at the time at Credit Suisse First Boston. Exhibit I-1 depicts the very simple idea behind the concept of competitive advantage period. That is, at “time zero,” or the valuation date, the firm has an economic position resulting from its prior investments in intangible assets that is expected to produce excess returns for a finite period of time.

Exhibit 2-1
Competitive Advantage Period

In short, a firm’s existing inventory of intangible assets produces an expectation of residual profit. However, like all assets, intangible assets do not last forever. Therefore, this expectation is finite in duration.

II. Definitions and Relationships – Net and Gross Residual Profit

For our purposes, there are really two primary measures, or definitions, of residual profit that matter: 1) net residual profit, and 2) gross residual profit. Net residual profit is residual profit after deduction of intangible development costs (“IDCs”). Net residual profit is, in fact, the firm’s operating profit less its required return on its routine invested capital (“RRORIC”).

² Insert Citation.
Correspondingly, gross residual profit is residual profit *gross of intangible asset investments*. That is, gross residual profit is residual profit in each period, *before deduction* of ongoing non-routine intangible asset development costs ("IDCs"). Said differently, gross residual profit is just net residual profit with IDCs added back.

Later in this chapter, we will describe two different definitions, or calculations, of gross residual profit: 1) expected steady state gross residual profit, and 2) available or deliverable gross residual profit. As we discuss in Appendix 2-A, there is an extremely important mathematical relationship between available gross residual profit, the depreciation method used to match intangible asset investments to revenue, and net residual profit.³

A. Net Residual Profit

1. Basic Definition

The basic formula for net residual profit is as follows.

(Formula 2-1) \[ \pi^{RN} = Sales - COGS - OPX - I - RRORIC, \]

where \( \pi^{RN} \) is net residual profit, \( Sales \) is net revenue, \( COGS \) is the firm’s cost of goods sold, \( OPX \) is the firm’s routine operating expenses (routine selling, general, administrative, and other operating expenses), \( I \) represents the firm’s non-routine intangible development costs, and \( RRORIC \) is the firm’s required return on its entire routine capital base. Note that, going forward, we will use the variables \( RRORIC \) and \( \pi^p \) interchangeably.

Since \( Sales - COGS - OPX - I \) is equal to operating profit, we can re-write Formula 2-1 as:

(Formula 2-2) \[ \pi^{RN} = \pi - RRORIC = \pi - \pi^p, \]

where \( \pi \) is the symbol for operating profit.

What Formulas 2-1 and 2-2 are saying is simple. Firms exist in order to yield a return to the capital that powers them. Thus, firms exist to produce at least a

³ In fact, as Appendix II-A shows, this relationship holds for any asset.
required return on routine invested capital, or RRORIC, plus a return to non-routine intangible asset investments ($\pi_{RN}$). Importantly, in a steady state equilibrium, $\pi_{RN}$ will always be positive. The reason for this is that, for all periods, prior period IDCs must earn a positive return in the current period.\(^4\)

The firm’s IDCs, given by the variable $I$, are investments in non-routine intangible assets that yield a return in current and/or later periods. Depending upon the firm’s industry and operating model, these might include R&D and legal investments associated with the development and maintenance of patent rights, know-how, and trade secrets. IDCs may also include marketing investments such as advertising and general marketing at trade shows or other events. In fact, while Formula 2-1 may include selling expenses in $OPX$, if the firm’s selling activities give rise to customer relationships that are long-lived and difficult for competitors to displace, then these costs should arguably be treated as an intangible asset investment and included in $I$.

2. **RRORIC**

It is obvious from the basic definition of net residual profit, that the estimation of $\pi_{RN}$ depends critically on the estimation of RRORIC. There are at least two methods of estimating RRORIC: 1) the direct estimation method (“DE”) and 2) the routine functional profits method (“RFP”). Each of these is taken up, in turn, below.

\(\text{a) Direct Estimation of RRORIC}\)

Direct estimation of RRORIC involves two primary steps: 1) estimating the current value of routine invested capital ($RIC$), and 2) estimating the required rate of return to $RIC$.

\begin{equation}
\text{(1) Estimating RIC}
\end{equation}

Routine Invested Capital is defined as follows.

(Formula 2-3) \[ RIC = P = POA + RI - NIL, \] \(^5\)

\(\text{---}\)

\(^4\) The reader with an economics background will realize that this means that even in monopolistic competition, net residual profit will be positive.

\(^5\) Note that Formula 2-3 is introducing the variable $P$ as a shorthand for $RIC$.  

DRAFT HIGHLY CONFIDENTIAL
where $RIC$ and $P$ represent Routine Invested Capital, $POA$ is physical operating assets measured at their market value, $RI$ is the replacement cost of any routine intangible assets, and $NIL$ is non-interest bearing liabilities.

Physical operating assets are, as the name implies, physical assets that are operated for profit. The adjective “operating” implies that some assets are “non-operating,” meaning that they are not owned by the firm for the purpose of supporting its operations, but rather are owned for some other purpose. Two common examples of non-operating assets are excess cash and passive investments. Excess cash, as the name implies, is cash in excess of the cash holdings needed to fund operations. Passive investments are investments held by the firm, for which the firm is a “passive investor.” This means that it has no control over the operations and uses to which the assets are put.

Valuation specialists usually value physical assets at either their observed market value, using market data to do so, or at their replacement cost. Valuation using observed market data generally involves discussions with company personnel regarding the company’s transactions with equipment vendors. Correspondingly, valuations that center around replacement costs involve the use of specialized data sources such as the *Marshall & Swift Valuation Service Guide*, the *Computer Economics* web site, and the U.S. Bureau of Labor Statistics *Producer Price Index*.

It bears noting that, from an economic perspective, because physical operating assets usually do not provide the firm with a barrier to entry, observed transactional market values should be roughly equivalent to replacement cost. In other words, the market should, if it is relatively efficient, value $POA$ at its replacement cost. If it did not, firms would either have an incentive to sell their physical assets and replace them (if the market price is higher than replacement cost), or keep their otherwise scrapped physical assets out of the market (if market price is lower than replacement cost). This arbitrage will tend to maintain a correspondence between observed market prices and replacement cost.

---

6 Importantly, we treat cash and working capital as “physical” for purposes of this discussion.
7 Marshall & Swift, L.P., 911 Wilshire Boulevard, 16th Floor, Los Angeles, CA, 90017.
Routine intangibles are intangible assets that are easily replicable by the firm, and that do not generate monopoly power. These are the non-tangible things that are necessary to operate what Buffett calls “businesses,” rather than non-routine intangible assets that give rise to what he refers to as a “franchise.” Examples include standard operating procedures, training manuals, operating procedures related to routine physical operating assets, and the workforce in place necessary to operate the firm’s physical operating assets.

In contrast to a non-routine intangible asset, which we think of as an idea or a relationship that is in some way difficult to replicate, and that gives rise to monopoly power, routine intangible assets either exist in the “public domain” or the “commons” (which means that they are accessible at a certain cost to all firms), or for some other reason they do not give rise to monopoly power. This implies that these intangibles are not sought in an attempt to generate monopoly power. Rather, the returns to these assets are known to be competitive. By definition, this means that the value of these assets is their replacement cost.

Non-interest bearing liabilities are the liabilities of the firm that do not bear interest – meaning that the firm does not explicitly pay interest on these liabilities. The most common example is accounts payable. The firm owes its suppliers money, but generally doesn’t pay an explicitly calculated interest amount on those liabilities. Rather, it pays “implicit interest” on payables (as well as any other non-interest bearing liabilities) in the form of a higher price for the inputs procured from its suppliers.

Why are non-interest bearing liabilities deducted from invested capital? At first blush it is not clear why some liabilities are netted against (deducted from) operating assets (i.e., the non-interest bearing kind) and others are not (i.e., the interest bearing kind, such as bank debt or bonds outstanding). After all, aren’t non-interest bearing liabilities still a form of capital that funds operations? And, therefore, shouldn’t these liabilities therefore be included in routine invested capital?

The primary reason for deducting non-interest bearing liabilities (payables) from operating assets is that the firm’s operating profit already contains the interest charge associated with non-interest bearing liabilities. That is, if a firm procures a component from an upstream supplier for a price of $100, and is obligated to pay the supplier in three months, we can expect that the $100 component price actually contains two separate prices: 1) $V$, or the immediate value of the good if
the purchaser paid immediately, and 2) \( r x V \), where \( r \) is the three month rate of interest charged by the upstream supplier for waiting to be paid.

This means that operating profit is already lower by the amount of this implicit interest charge. This, in turn, implies that the firm’s measured operating profit does not have to cover this source of capital. In other words, operating profit does not have to provide a return to payables because it already reflects the provision of this return.

(2) **Estimating RRRORIC**

Given an estimate of RIC, we still need an estimate of the required rate of return to the routine invested capital base. We use the variables RRRORIC, \( r^p \) and \( r^{RIC} \) interchangeably to designate the required return to routine intangible capital.

The process of estimating \( r^p \) involves finding benchmark companies that solely, or at least primarily, own routine invested capital, and estimating the weighted average cost of capital, or WACC, for these companies. We discuss the weighted average cost of capital, and its components, at some length in Chapter 3.

Numerous searchable databases exist that allow the analyst to search for companies in the same industry as, or a contiguous industry to, the firm that owns the intangible assets being valued.\(^{10}\) By finding companies that only perform functions similar to the routine functions of the firm whose intangibles are being valued, and then estimating the weighted average cost of capital for these companies, we can develop a sample of benchmark companies whose average, median, and perhaps interquartile range, tell us something about the RRRORIC that should be applied to the routine invested capital base of the company that we are studying.

For example, when valuing the intangible assets of manufacturing firms it is common to search for contract manufacturers in the same or similar manufacturing sectors as the firm of interest. The reason that contract manufacturers’ costs of capital are used as the data to estimate \( r^p \) is that contract manufacturers (also known as “manufacturing service providers”) generally do not develop their own product technologies or own significant customer-based intangibles. Thus, their returns represent returns to a physical operating asset

---

\(^{10}\) At the time of this writing, these databases include CapitalIQ, Compustat, Amadeus, Orbis, Hoovers, and several others.
base, along with returns to the workforce in place and routine intangibles (such as standard operating procedures) that are needed to operate the physical plant and equipment.

Similarly, the returns to routine distribution and routine selling invested capital bases can be estimated by examining the required rates of return (WACCs) of companies that perform routine distribution. As with contract manufacturers, routine distributors generally do not own non-routine customer-based or technology intangibles. Rather, these firms exist to aggregate inventory. As such, their returns also represent returns to a physical operating asset base, along with returns to the workforce in place and routine intangibles (such as standard operating procedures) that are needed to operate the physical plant and equipment.

Just as residual profit can be measured in gross and net terms, so too can RRORIC. In other words, the required return to routine invested capital can be computed on a net basis (after depreciation of routine capital) or a gross basis (before depreciation).

The OPX term in our definition of net residual profit contains the depreciation of physical routine assets (as well as some routine intangible assets, such as software). Given this, we are looking to estimate RRORIC on a net, rather than gross, basis.

Appendix 2-A offers the reader a general discussion – applicable to all assets, including RIC – of how net and gross valuations relate to one another. As shown in the appendix, the proper formula for application of $r^p$ to RIC is:

(Formula 2.4) \[ \pi^p = RRORIC = RIC \times (r^p - g), \]

where $\pi^p$ is used to denote RRORIC, and $g$ is the firm’s long term equilibrium growth rate.

Some readers are at this point surely asking why the required rate of return to routine invested capital, $r^p$, is not simply multiplied directly by RIC in Formula
2.4. The reason is discussed in more detail in Appendix 2-A, but for our purposes here it suffices to say that a firm that is growing – or for that matter a single asset whose profit stream is growing over time – will require a lower rate of return on its invested capital base in each period than a firm that is not growing. Said differently, in order for an asset (in this case RIC) to be equal in present value, given a positive growth rate of \( g \), to an otherwise identical asset with a zero growth rate, the asset whose returns are growing must have a lower rate of return in each period than the zero growth asset in order to have the same total return in each period (and thus the same present value).

Importantly, Formula 2.4 provides the formula for the first period (or current period) of cash flows relating to RIC. Because the firm is growing at \( g \), for forecasting purposes we must then take the \( \pi^p \) given by Formula 2.4, and forecast it forward using a growth rate of \( g \) in each future period.

\[ \text{b) The Routine Functional Profits Method of Estimating RRORIC} \]

It is possible in some cases to estimate RRORIC indirectly, rather than directly. This approach, the “routine functional profits method,” is advisable in cases where either RIC or \( r^p \) cannot be estimated reliably.

For example, if we know that a “normal” operating margin (defined as operating profit / sales) in a given industry is 5 percent of sales, then we can use this as a proxy for RRORIC. In such a case, Formula 2-2 becomes:

\[ (\text{Formula 2-5}) \quad \pi^{RN} = \pi - OM \times Sales, \]

where \( OM \) is the “normal,” or “routine” operating margin. As an example, it is fairly common to assume that a “routine operating margin” for a distributor is equal to around 2 percent of sales. Other estimators of RRORIC are also possible. Continuing with the routine distributor example, it is also commonplace to assume that distributors, in the absence of non-routine intangibles, should earn a routine or normal profit equal to a markup of 10 to 15 percent on their operating profit.

\[ \text{[It bears noting that Appendix II-A gives a very important mathematical result, which is employed throughout this book. The reader is encouraged to at least peruse Appendix II-A in order to understand the key “takeaway” from that appendix – namely, that valuation methods that discount operating profit (net of depreciation) into perpetuity are fully reconcilable to methods that value a single asset generation (gross of depreciation) over its economic useful life.]} \]
expenses. In such a case, one would replace the term \( OM\times Sales \) in Formula 2-5 with \( OPX\times M \), where \( M \) is the routine markup on the distributor’s operating expense.

Under the Routine Functional Profits method, the analyst identifies functions within the enterprise that rely solely on routine invested capital, and then searches for benchmark companies whose profits provide an estimate of the arm’s length profits attributable that routine invested capital. Examples include (but are not necessarily limited to) routine manufacturing, warehousing and distribution activities, routine administrative functions, and possibly functions such as procurement and selling. Numerous searchable databases exist that allow for careful analysis of benchmark company sets, and estimation of \( RRORIC \) using the RFP method.

It is important when estimating \( RRORIC \) under the Routine Functional Profits method that the analyst select benchmark companies that are clearly routine in nature. That is, the analyst should select firms that do not appear to hold material non-routine intangible assets. This means that seemingly comparable companies with significant R&D activity, material trademark and corporate identity value, customer-based assets resulting from a deep, broad, and technical sales force, and firms that clearly earn profits that are well in excess of normal economic profits for any other reason, should all be avoided.

When determining whether or not a potential benchmark company is “comparable” enough to be used as an estimator of the \( RRORIC \), it is not always necessary that the potential benchmark company operate in the same industry as

\[ \text{12} \quad \text{Since a distributor’s COGS (cost of goods sold) is not a value added cost (that is, it doesn’t represent a value added activity of the distributor since it is simply a purchase from an upstream supplier), and since markets generally remunerate a firm’s value added costs, marking up a distributor’s \( OPX \) (which represents the distributor’s value added activity) is a common shorthand method for estimating its normal profit.} \]

\[ \text{13} \quad \text{These are the same databases noted earlier (CapitalIQ, Compustat, Amadeus, Orbis, Hoovers, and several others).} \]

\[ \text{14} \quad \text{It bears noting that we do sometimes see purely routine firms earning economic profits. For example, this can happen in the commodities industries due to the fact that supply capacity in the commodities industries (mining and extraction, primary metals, etc) responds very slowly to shifts in demand. The result is a very steeply sloped supply curve, which, when demand shifts outward, means that prices rise rapidly. Firms operating at supply prices below the market equilibrium then earn what is referred to by economists as “inframarginal rents.” In other words, in supply constrained environments (the short run) it can be the case that purely routine physical capital (along with the routine intangible capital necessary to operate it) can earn residual profit.} \]
the company that is being analyzed. While it is certainly preferable to find routine companies operating in the same industry as the “tested” company (the company being analyzed), it is sometimes not possible. In such a case, companies can be examined in other, perhaps contiguous, industries – so long as these companies perform functions that are in fact functionally similar to the routine activities being benchmarked.

One common mistake, which can have a very large impact on the estimate of \( \text{RRORIC} \) is to estimate functional profits without regard to asset turnover. Asset turnover is defined generally as \( \frac{\text{Sales}}{\text{Assets}} \), but for this purpose we define it as follows.

\[(\text{Formula 2.6}) \quad AT = \frac{\text{Sales}}{\text{RIC}}.\]

Asset turnover is a measure of how efficiently a company converts its assets (its invested capital) into revenue. In order to understand the importance of asset turnover for the measurement of routine functional profits, examine the following formula.

\[(\text{Formula 2.7}) \quad \frac{\pi}{\text{Assets}} = \left( \frac{\pi}{\text{Sales}} \right) \frac{\text{Sales}}{\text{Assets}} = \left( \frac{\pi}{\text{Sales}} \right) (AT) \Rightarrow \left( \frac{\pi}{\text{Sales}} \right) = \left( \frac{\pi}{\text{Assets}} \right) \left( \frac{1}{AT} \right).\]

What Formula 2.7 shows us is that margins (profit divided by sales) in a competitive industry are determined in large part by the natural asset turnover rate of that industry. The reason for this is that competitive markets (competitiveness being a feature of markets in which only routine capital is deployed) equate risk adjusted returns to assets (or invested capital). Thus, the higher is the asset turnover rate in a competitive industry, the lower will be the observed operating margin in that industry.

A commonly employed illustrative example is one in which a grocery store is compared to a steel manufacturer. Both of these industries are relatively routine in nature. However, because groceries’ assets are mostly inventory, they turn their assets over roughly 6 times per year. By contrast, steel manufacturers are heavily capitalized, and exhibit asset turnover rates of around 1. If we assume for simplicity that both types of businesses have a required rate of return to operating assets of 12 percent, competition will ensure that the steel industry shows an average operating margin of around 12 percent (because 12 percent operating margin times an asset turnover of 1 equals the required 12 percent rate of return), whereas competition will force the grocery store margins down to 2
percent (because a 2 percent operating margin times an asset turnover of 6 equals the 12 percent required rate of return). Both industries are routine in our example. However, the margins that they exhibit are dramatically different.

The implication is obvious. If one uses operating margins (or for that matter cost plus markups) when applying the RFP method, it is critical to ensure that the benchmark companies’ asset turnover rates are consistent with those that one would expect to see for the routine activities being performed by the company being analyzed. Otherwise, one’s assumptions regarding an appropriate operating margin or cost plus markup for, say, manufacturing activities, may imply highly non-routine returns to invested capital.

3. Net Residual Profit – Treatment of IDCs
   
a) Cash Net Residual Profit

There are three commonly employed calculations, or measures, of net residual profit. The difference among the three definitions centers on how the costs related to previously sunk intangible development costs (IDCs) are treated. That is, the three different definitions each treat depreciation of sunk IDCs differently.

Under the first definition (covered above), I, which is current period IDCs, is simply deducted from revenues in the period in which the intangible development costs are sunk. In other words, no attempt is made to match investments with revenue. We can call this basic definition of residual profit “current period residual profit,” or “cash net residual profit” (CNR).15

---

15 It should be noted that cash net residual profit is not technically cash, since certain income statement deductions like depreciation are non-cash charges. However, current period / cash net residual profit can easily be converted to cash by replacing non-cash charges such as depreciation with their cash counterparts such as capital investment.
However, since we know that $I$ is an investment, and investments pay off in periods after the investment is made, it makes sense to match the firm’s intangible development costs with the revenues that those investments generate. In other words, it may be desirable to measure net residual profit on an accrual basis – properly matching revenues with investment costs. This means that if we are capitalizing intangible asset investments, then it follows that we should consider deducting the depreciation of the intangible capital stock in each period, rather than the current cost of $I$. We refer to this calculation of net residual profit as “accrual net residual profit” (ANR).

We can accomplish this by switching the term $I$ in the formulas above with the following expression in each period:

(Formula 2-8) \[ I = \sum \delta_t, \]

where $I$ becomes the sum of the layers of depreciation of previously sunk investment costs that are being matched against revenue in the current period. That is, $\delta_t$ is the current period depreciation of intangible asset investments made in period $t$, given that the investments made at time $t$ are still “in service.” By “IDCs that are still in service,” we mean prior period intangible development costs that are paying off (supporting the firm’s revenue stream) in the present period.

In short, Formula 2-8 simply sums the current period depreciation of currently relevant prior period “layers” of intangible asset investments. Thus we replace $I$ (current period IDCs) in prior formulas with the $I$ given in Formula 2-8.

Appendix 2-A to this chapter provides an overview of the mathematics of depreciation. In addition, the Microsoft Excel™ files that accompany this book provide the reader with a rigorous spreadsheet model that allows him or her to use actual company data to, among other things, capitalize and amortize the firm’s intangible asset investments. Specific worksheets in the Excel™ file capture the concepts covered in this chapter’s mathematical appendix.

---

16 It bears noting that this formula, as well as formula II-8, implicitly assumes that $I$ is incurred in the middle of period (half-year convention)
Sometimes firms’ IDCs do not begin to pay off immediately, but “gestate” or take some time before they begin to pay off. In such a case, we have to modify our modeling of IDC depreciation to account for the fact that current period depreciation is really depreciation from investments made in periods at least as far back in time as the gestation lag.

In other words, if the gestation lag is \( L \) periods, then for any time less than \( L \) periods prior to the current period no depreciation is occurring currently. The reason for this is that, as the name implies, IDCs sunk between \( -L \) and the current time are still “gestating.” That is, they have not come into service yet, and therefore no depreciation of those investments is applied to current period revenue.

To illustrate, in the case of straight line depreciation of prior investments Formula 2-8 becomes:\(^{17}\)

\[
I = \sum_{t=-L}^{-L}(I_t).
\]

where, \( L \) is the average amount of time that a dollar invested in \( I \) takes to “gestate,” and \( N \) is the economic life of the intangibles (the number of years over which \( I \) is depreciated in straight line fashion). All other variables are defined as before.

Formula 2-9 is simply saying that if we have a gestation period of \( L \), then we shift backward our period of interest (the years of IDCs that are relevant to current period revenue) by \( L \) years.

c) Required Returns – Economic Net Residual Profit

Sometimes it is important to ascertain whether or not the firm is earning economic profit from its intangible asset investments. That is, it is often worth understanding whether or not the firm’s net residual profit is sufficient to cover its required rate of return on its IDCs. In the case wherein the firm’s economic

\(^{17}\) It bears noting that this formula is also general enough to capture what we will call “convex” depreciation in the mathematical appendix. It does not, however, capture a constant depreciation rate, since a constant depreciation rate implies that \( I \) never fully depreciates. That is, under a constant depreciation rate, some portion of \( I \) always remains, since the percentage remaining of \( I_{t-N} \) in any period \( t \) is simply \((1-\delta)^t\), which is always \( >0 \).
net residual profit (ENR) is positive, it is earning true economic profit in the microeconomic sense of the term. Correspondingly, in the case wherein the firm’s

The valuation implications of this distinction (positive or negative ENR) are critical. Firms that earn zero or negative ENR have intangible assets whose value is equal to, or less than, respectively, the IDCs that were invested to generate the intangibles. More to the point, the presence or absence of ENR is the determinant of whether or not a firm’s intangible asset stock is worth more than the cost to “produce” the intangibles.

As for the necessary adjustment to our formula for net residual profit, imagine that we have a gestation lag, $L$, of one year. This means that at the end of one year, the required total return to an investment of $I$ is equal to $I_t e^{r_L} = I_t e^r$, where $r$ is the required return to $I$. In other words, the opportunity cost of a dollar of investment means that by the time that investment comes into service after a gestation lag of one year, the required profit flow that should be inserted into Formula 2-1 to replace $I$ has to cover both the original investment of $I$ plus a year’s worth of “interest” on that investment that has accrued during the gestation lag. In essence, the investment by the firm is now $I_t e^r$.

This means that formula 2-1 can be adjusted fairly simply, as follows. Note that we are assuming that $N$ years of prior investment is relevant today, which is consistent with straight line depreciation.

(Formula 2-10) \[ I = \sum_{t=-L}^{-(N+L)} \pi^{lt}, \]

where $\pi^{lt}$ is the profit flow in the current period that is required to cover the depreciation of all currently in service prior period IDCs, as well as these IDCs’ required returns in the present period. Put differently, the $I$ that should be matched against revenue in each period is equal to the sum of the per period required profit flows, for this period, that are paying back in present value the $N$ layers of IDCs that were sunk during the periods between period $-(N+L)$ and $-L$.

We address the question of what, exactly, is the per period profit flow to prior investments in the mathematical appendix. Thus, the appendix, and as noted the accompanying Excel™ files, allow the reader to understand and estimate the per period required profit to the firm’s sunk intangible asset investments.
4. **Net Residual Profit – Summary**

It may be helpful to the reader to summarize the primary formulas given above for net residual profit.

First, we have current period net residual profit. This was given in Formula 2-1, now simply rewritten as Formula 2-11, as follows.

(Formula 2-11) \[ \pi^{RN} = Sales - COGS - OPX - I - RRORIC. \]

However, as noted, the problem with this formula is that \( I \) in the current period does not really represent the intangible asset investment costs associated with the \( Sales \) term in Formulas 2-1 and 2-11. Therefore, we need to capitalize \( I \), and match the amortization of prior period “layers” of \( I \) to today’s revenues.

The most commonly employed approach to this, as stated, is to simply capitalize and amortize previous period investments in \( I \). The formula with this adjustment would be:

(Formula 2-12) \[ \pi^{RN} = Sales - COGS - OPX - \sum \delta_t - RRORIC, \]

Where the term \( I \) is simply replaced with either Formula 2-8 or 2-9 (depending upon whether or not it is appropriate to model a gestation lag).

However, while this is the most commonly employed approach to matching prior investments with current revenue, it still does not deduct all economic costs – inclusive of the time value of money, or required rate of return, on sunk IDCs – from revenue. Therefore, we include the time value in Formula 2-13, below.

Formula 2-13 \[ \pi^{RN} = Sales - COGS - OPX - \sum \pi^R - RRORIC, \]

where we have simply replaced \( I \) from Formula 2-1 with the right hand side of Formula 2-10. Formula 2-13 is the formula for net residual profit that gives us the firm’s true economic profit or loss.
B. Gross Residual Profit

Whereas net residual profit is the economic profit realized by the firm net of $I$—that is, net of its investments in intangible assets, gross residual profit is the residual profit that the firm generates before it reinvests some of that residual profit into IDCs. That is, gross residual profit is simply the profit earned from prior investments in intangible assets, before it is consumed in one of three possible uses. Gross residual profit is available to the firm for use in: 1) maintenance of existing intangibles (a form of retained earnings), 2) creation of new intangibles (also a form of retained earnings), or 3) dividends to shareholders.

In a “steady state,” gross residual profit is the residual profit earned by the firm, operating as a going concern, after all costs have been covered except investments in intangible property.\(^\text{18}\) Gross residual profit in a steady state will therefore be partially reinvested in IDCs, simply because by definition in a steady state the firm will continue to invest in intangible assets.

Obviously, steady state gross residual profit looks formulaically very similar to net residual profit. Formula 2-14 repeats Formula 2-1 for net residual profit given earlier, except that $I$ is not deducted from sales.

\[
\pi^{RG} = Sales - COGS - OPX - RRORIC,
\]

where $\pi^{RG}$ is gross residual profit, and all other variables are defined as before. Formula 2-15 then modifies Formula 2-2, showing it as net residual profit plus the “addback” of $I$.

\[
\pi^{RG} = \pi + I - RRORIC.
\]

These formulas make plain one of the key advantages of working with the gross, rather than net, concept of residual profit. In cases where net residual profit is negative, gross residual profit may still be positive so long as $I$ is greater than $\pi - RRORIC$.

It is sometimes said that if the firm is not earning net residual profit, then it must not have valuable intangible assets. This statement is not, strictly speaking, true.

\(^{18}\) It is probably already clear that by “steady state” we mean that the firm is in an equilibrium position that is not subject to change over time.
So long as gross residual profit is positive, and the firm can in fact rely on this positive gross residual profit for some period of time if it were to discontinue its intangible asset investments, there must be some value to currently existing intangibles – simply because some gross residual profit is available for consumption by shareholders.

C. Comparing Net and Gross Residual Profit

Exhibit 2-2 provides a comparison of net and gross residual profit in the format in which these profit definitions are usually calculated.

### Exhibit 2-2

**Gross and Net Residual Profit**

<table>
<thead>
<tr>
<th>Line Item</th>
<th>Value</th>
<th>Included In Residual Profit Definition?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Sales</td>
<td>100</td>
<td>Y</td>
</tr>
<tr>
<td>B Cost of Goods Sold</td>
<td>30</td>
<td>Y</td>
</tr>
<tr>
<td>C Routine SG&amp;A</td>
<td>20</td>
<td>Y</td>
</tr>
<tr>
<td>D Marketing Expenses (IDC)</td>
<td>5</td>
<td>N</td>
</tr>
<tr>
<td>E R&amp;D (IDC)</td>
<td>7</td>
<td>N</td>
</tr>
<tr>
<td>F Routine Invested Capital</td>
<td>90</td>
<td>Y</td>
</tr>
<tr>
<td>G Required Rate of Return to Routine Invested Capital</td>
<td>10%</td>
<td>Y</td>
</tr>
<tr>
<td>H RRORIC</td>
<td>9</td>
<td>Y</td>
</tr>
<tr>
<td>I Gross Residual Profit</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>J Net Residual Profit</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 2-2 shows a firm generating 100 units of revenue, and bearing routine costs of 70 (COGS plus routine SG&A). Exhibit 2-2 assumes that marketing and R&D are both investments in intangible assets – thus the firm has I equal to 12 (marketing of 5 and R&D of 7). Finally, the exhibit assumes that the firm has a routine invested capital base of 90, and a routine required rate of return of 10 percent. Given I equal to 12, gross residual profit must be 12 higher than net residual profit. And, given net residual profit equal to 9, gross residual profit must be 21.

---

19 Note that the assumption of 100 units of revenue will be commonly employed throughout this book. This assumption allows one to think of other financial data for the firm in percentage of revenue terms.
Exhibit 2-2 can be thought of as a one period example of the firm in a steady state. Exhibit 2-2 can thus be viewed as offering a picture of the firm’s gross and residual profit in a typical period (e.g., one year).

However, it is also instructive to examine the firm’s expectations of future gross and net residual profit as of a point in time. Since the value of intangible assets is closely related to the discounted residual profit that the intangible are expected to generate in the future, this gives us a pictorial view of the value of the firm’s prior investments in intangible assets on both a gross and net basis.

Exhibit 2-3
Gross and Net Residual Profit Expectations as of a Point in Time

Exhibit 2-3 depicts the firm’s expectations for its flows of net and gross residual profit through time, beginning at “time zero” (the origin of the graph, where the horizontal and vertical axes cross). Looking forward in time, the exhibit shows the firm as having an expectation of net residual profit, given in the trapezoid shaped areas B and C, that continues indefinitely. This is reflective of the fact that net residual profit assumes that the firm is investing I in each period, which in turn implies that the firm expects to be able to leverage its existing intangible assets into its development of future, successful, intangible assets. In other words, net residual profit extends well into the future, and perhaps indefinitely, because the firm expects to maintain and extend its intangible asset inventory going forward.

---

20 This is not a necessary assumption. For example, see the research of Michael Mauboussin and others on the “market implied competitive advantage period.”
However, Exhibit 2-3 also shows the firm’s expectation for gross residual profit. And, this expectation is clearly finite. In other words, Exhibit 2-3 is implicitly defining gross residual profit assuming not only that I can be “added back” to net residual profit, but also that no further intangible development costs are sunk by the firm after time zero. This implies that gross residual profit would decline to zero over some finite time horizon. Thus, gross residual profit in Exhibit 2-3 is the sum of areas A and B.

The rate at which gross residual profit declines in the absence of reinvestment in I is a function of a number of factors. This rate of decay is the key determinant of the “economic life” of the firm’s intangible asset stock. The subject of the economic life of intangible assets is one that is examined carefully in Chapter 4.\textsuperscript{21}

A reasonable question for the reader to pose at this point is this: “Isn’t Exhibit 2-3 showing something other than a steady state? In other words, why doesn’t gross residual profit also extend into an indefinite time horizon? After all, if the firm really expects to continue its investments in things like R&D and marketing, it also expects that it will continue to earn gross residual profit into an indefinite time horizon. Put differently, the firm cannot expect net residual profit to extend well into the future if the gross residual profit is not there to fund ongoing IDCs.”

This question highlights a distinction that was not immediately apparent when examining gross residual profit in the formulas above. Namely, we can define gross residual profit in two ways: 1) “steady state gross residual profit,” and 2) “deliverable gross residual profit.”

Steady state gross residual profit was defined earlier, and as the question noted above points out, is expected to continue for an indefinite future time period. So long as some portion of gross residual profit is expected to be reinvested in I, then gross residual profit is expected to remain positive. Therefore, we would show steady state gross residual profit in the above exhibit by extending a horizontal line rightward from the vertical axis, parallel to the net residual profit line.

\textsuperscript{21} A question taken up in Chapter 5 is whether or not the present value of Areas A and B, which is gross residual profit, is equal to the present value of areas B and C, or net residual profit. There, we show that under a certain definition of economic life, the present value of A plus B is equal to the present value of B plus C.
Deliverable gross residual profit, on the other hand, is what is shown in Exhibit 2-3. Deliverable gross residual profit is profit that the firm could actually deliver to its shareholders if in fact it stopped investing in $I$. Deliverable gross residual profit would in fact decay to zero, and would in fact be positive and equal to net residual profit plus $I$ at time zero. This implies that it is somewhat imprecise to say, as we did earlier that the firm expects gross residual profit to decline. As the question noted above points out, gross residual profit is only expected to decline to zero if the firm expects to “harvest” rather than maintain its intangible assets.

Exhibit 2-3, and the concepts of deliverable gross residual profit and net residual profit that are illustrated in that exhibit, are precursors to some of the valuation analysis covered in later chapters (particularly Chapter 5). Specifically, we will be examining the conditions under which the present value of gross residual profit is equal to the present value of net residual profit. We also use the relationship between gross and net residual profit extensively in our valuation and pricing analyses related to licensing of intangible assets.

D. Cash Versus Accounting

It is probably obvious to the reader that, thus far, we have been somewhat vague about whether or not our profit definitions should be measured on an accrual or a cash basis. That is, we have in some places discussed measures of “profit” and in others we have referred to “cash flow.”

Certainly, the formulas above use variables that are generally thought of as accrual accounting variables. For example, the $OPX$ variable in Formula 2.1, if defined in the traditional way, would include depreciation of physical (and in limited cases some intangible) capital, rather than cash investments in physical plant and equipment. However, it is important to recognize that we do not intend to imply that the flow of residual profit should necessarily be determined on an accrual, rather than cash, basis.

In fact, because our interest is centered on the value of the firm’s stock of intangible assets, as a share of its enterprise value, it is fair to say that the formulas given thus far should be thought of in a way that allows the analyst to arrive at cash operating profit (operating cash flow), and cash $RRORIC$. Put differently, because we want the firm’s intangible asset values to reconcile to enterprise value – meaning that we want all of the firm’s asset values to “add up” to enterprise value – the implication is that the $OPX$ term in Formula 2.1 should be thought of as cash operating expense.
This means that certain adjustments should be made to OPX measured on an accrual accounting basis. These include the standard capital-related cash flow adjustments to OPX, which are: 1) adding back depreciation and deducting capital investments, and 2) deducting the change in the firm’s net working capital.

E. Pre-tax Versus After-tax

The reader will also have noticed that the definitions given thus far are all pre-tax definitions. That is, net and gross residual profit, and for that matter RRORIC, are all defined as profit flows before the government deducts its claim from the firm’s operating profit flow. Thus, as with the cash versus accrual issue above, we have been somewhat vague about our approach to taxes.

To some readers, the use of pre-tax definitions may appear to be problematic in light of our statement earlier that we want to arrive at valuations for the firm’s intangible assets that, coupled with the value of routine invested capital, reconciles to enterprise value. Given that enterprise value is equal to the present value of the after-corporate tax flows of income to debt and equity holders, how can it be the case that the present value of “pre-tax” routine and non-routine cash flows is equal to the firm’s enterprise value?

The answer is that they are not equal. The reader is correct that the pre-tax definitions used thus far will include the value of the government’s claim to the profit streams generated by the firm’s asset categories (i.e., it will include the corporate taxes paid on the assets’ profit streams). This inclusion of the government’s claim to a portion of each asset’s cash flows is intentional.

The logic is as follows. First, it must be recognized that all assets trade at the present value of the cash flows that they generate before deduction of the taxes that the asset’s owner will pay. That is, assets trade at the present value of their pre-tax cash flows, where “taxes” are defined as the taxes that the asset’s owner must pay. Why is this statement true? Simply because if it was not, assets would never trade. If an asset owner expects his or her asset to generate $100 of taxable income at a tax rate of 30% (meaning that the asset owner will pay taxes to the government at a rate of 30% on income generated by the asset), then the asset owner would never sell the asset for $70 (its after-tax value). Rather, the asset owner would sell only for $100 (the asset’s pre-tax income) or greater. Why? Because if the asset owner sold the asset at its after tax value ($70), he or she
would then be taxed on the proceeds of $70, leaving $49 ($49 = $70 \times (1-30\%))
Obviously, in such a case, the asset’s owner would be better off just holding on to
the asset, rather than selling, since holding the asset would mean receipt of $100,
less taxes of $30, or a net income to the asset owner of $70.

This same logic applies directly to the firm, and its intangible assets. The
confusing thing is that the firm and its assets are generally subject to two layers of
taxation. First, the firm’s operating income is taxed by the government, at the
corporate income tax rate. Second, the firm’s debt and equity holders are taxed
on their returns, at the appropriate ordinary income or capital gains tax rates.
From the perspective of the firm’s income statement, the flow of income accruing
to debt and equity is after-tax (after the corporate level tax). But, from the
perspective of the invested capital holders’ (debt and equity) income statements,
the income accruing to invested capital is pre-tax, because the flows of interest
(debt returns) and dividends and/or capital gains (equity returns) are pre-tax to
the debt and equity holders. Thus, we see that the enterprise value of the firm
(the value of the debt and equity capital sources that fund the firm) is the present
value of the pre-tax cash flows earned by these invested capital sources.

Coming back to the question of whether or not we should be defining residual
profit in pre-tax or after-tax terms, it should be clear by now that we always
value an asset at the present value of the cash flows out of which the asset’s
owner will pay taxes (we value an asset at the present value of its pre-tax cash
flows). However, the question is whether pre-tax means pre-corporate tax, or
pre-tax to the invested capital sources. If we wish to determine the value at
which intangible assets should trade in the open market, among the firms that
can trade them, we need the pre-corporate tax income that the intangibles will
generate. Otherwise, the firm letting the asset go (selling) would be better off not
selling. On the other hand, if we wish to derive the value of the intangible asset
as a share of the firm’s value – i.e., as a share of the value of the firm’s debt and
equity capital – then we need to measure the after-corporate tax (but pre-tax to the
debt and equity capital sources) income flow.

III. Which Costs Are IDCs, and How Much Do Firms Invest?

One of the trickier jobs for the analyst interested in the value of an enterprise’s
intangible assets is determining which of the firm’s costs are “period costs,”
meaning that they are simply per period inputs that yield revenue in the period in
which they are procured, and, by contrast, which costs are really intangible asset
investments. While the answer to this question varies by industry, and within industries by firm, some generalizations are possible.

First, as discussed in Chapter 1, it is helpful to distinguish between two primary categories of intangible assets: technology, and customer-based intangibles. Within these two categories, there are a few types of costs that one may see on a firm’s profit and loss statement (or in its financial footnotes) that may give rise to valuable intangible assets (residual profit in later periods). An abbreviated, and certainly not exhaustive, discussion of these is given below.

Customer-based intangible asset development costs may include the following cost categories.

- **Marketing.** Some firms report marketing costs separately from selling, and as a separate component of SG&A. Marketing costs generally consist of things like trade shows, advertising costs, and retailer support.

- **Selling.** Sales costs, particularly those related to a trained and capable sales force, often represent an intangible development cost. While there are certainly some industries in which selling activity is commoditized in nature, in complex industries, where the sales activity is highly technical, selling activity gives rise to what economists call “localized information.” Localized information, as the name implies, is information that is non-public and difficult to obtain in the open market. For example, large technology firms often understand their clients’ entire IT infrastructures, IT personnel organization charts, IT asset amortization rates, and buying patterns. Such highly localized information about customers can give rise to valuable pricing power.

- **Discounts.** One interesting question is whether or not price reductions or discounts from a “standard” or “list” price represent a selling-related IDC. In general, price reductions for existing customers are a form of price discrimination. As such, they represent the *exercise* of market power by the firm (pricing at the highest price that the market will bear, on a customer-specific basis), rather than an investment in obtaining market power. By contrast, discounts provided in order to obtain a new customer are real reductions in profit that produce later benefits. As such, they may represent investments in customer-based intangibles.

- **Branding.** Brand related costs, including those related to trademark registration are frequently a form of intangible development cost. Branding initiatives provide customers with an assurance of stability, and
trademarks signal quality. These, in turn, give rise to an expectation of future patronage by customers.

Correspondingly, technology-related intangible development costs may include the following:

- **Research and Development.** R&D is an extremely broad designation. As the name implies, research and development is usually a two part process. Research is the process by which companies identify and screen promising new technologies. Correspondingly, development is the process by which new technologies are developed into commercially useful products or processes. R&D can result in patented technologies, or non-patented trade secrets and “know-how.” R&D investments are rarely period costs. That is, in nearly all cases, reported R&D produces intangible assets.

- **Engineering.** For some companies, engineering is not distinct from research and/or development. For others, however, engineering is a distinct process, frequently involving customization of products for specific clients or markets. Engineering can produce pricing power by making a customer’s assets and processes specific to the engineered products. This “asset specificity,” as it is called in the economics literature can result in pricing power. Further, engineering is sometimes directed at the production process, and can result in unique cost saving measures that the firm can retain for some period of time (meaning that the firm does not pass these efficiencies immediately to its customers through price cuts).

- **Legal.** The legal function is, surprisingly, an intangible development cost in a few industries. For example, in the generic pharmaceutical space, legal effort is a critical determinant of the timing of market entry, which in turn is a critical determinant of the returns earned by a generic pharmaceutical maker. Other legal costs can also be intangible development costs. For example, costs defending and maintaining patents, or trademarks, are important intangibles-related costs.

Finally, it bears noting that there are sometimes investments in acquisitions and in-licensing transactions that are a form of intangible development cost.

- **Acquisitions.** Firms sometimes invest in intangibles by acquiring other firms that own them, rather than internally development the intangibles. While the acquisition price such a case clearly does represent a market
value for the acquired intangibles, rather than the direct cost of investment, from the point of view of the acquirer this market value is in fact a development cost. That is, it is analytically no different from other IDCs, given that the price paid for the acquisition will pay off in future periods. It is quite possible (perhaps even likely) that the rate of return realized by the acquiring firm on these investments will be lower than its average rate of return on its internal intangible development costs, simply because the target, or “acquiree,” is usually able to extract some of the future benefit from the acquirer through the acquisition price.

- Licensing. Similarly, licensing costs can represent an investment in intangible assets. For example, in the pharmaceutical sector, it is common for a firm to in-license an early stage compound from another firm. The in-licensed compound may not be ready for sale until it has passed several stages of clinical trials and undergone significant additional development activity. In this case, the lump sums and/or royalties paid during the licensee’s development period represent intangible development costs.

While publicly available data do not allow us to easily identify each of the intangible development costs listed above, costs such as R&D and (sometimes) marketing are reported in companies’ publicly filed reports. In order to provide the reader with sense for the magnitude of the R&D and marketing investments of publicly traded firms, Exhibits 2-4 and 2-5 provide statistics for US firms, for R&D and marketing as a percentage of sales, by industry.

Exhibits 2-4 and 2-5 were developed using CapitalIQ™ (“CapitalIQ”). Capital IQ is a web-based research platform with data on over 61,000 public companies, worldwide, taken directly from public filings. Capital IQ employs the Global Industry Classification Standard (“GICS”). GICS was developed by MSCI and Standard & Poor’s and consists of 10 Sectors, 24 Industry Groups, 67 Industries and 147 Sub-Industries.22

Exhibit 2-4 shows the number of observations (firms), the lower quartile (“LQ”), median, and upper quartile (“UQ”) R&D-to-Sales ratios, by industry.

---

22 Exhibits 2-4 and 2-5 were developed using the following screening criteria. First, the entire database of 61,139 public filers worldwide was screened to include only US firms. The remaining 18,309 were then screened for those showing three years of data (either reported R&D or marketing information). The remaining 1,674 firms reporting R&D were then screened to retain firms with revenues greater than $10 million, leaving a final sample of 1,119 firms. Correspondingly, the remaining 2,253 firms that reported marketing were then screened to retain firms with revenues greater than $10 million, leaving a final sample of 1,742 firms.
The results given in Exhibit 2-4 are fairly intuitive. Pharmaceutical companies have the highest R&D-to-Sales ratios, with a median of 18.9 percent. Correspondingly, companies in the “food, beverage, and tobacco” industry classification have the lowest R&D intensity, exhibiting a median ratio of 1.0 percent. Not surprisingly, companies in the technology sector (semiconductors, software, and technology hardware) are R&D intensive, and traditional manufacturing companies (automotive, capital goods, energy, etc.) are not. As we will see in later chapters, there is a strong positive correlation between observed technology royalty rates within an industry classification, and R&D intensity.

Exhibit 2-5 displays the data for marketing investments.
Exhibit 2-5
Marketing Investments as a Percentage of Sales, By Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Observations</th>
<th>IQR</th>
<th>Median</th>
<th>UQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobiles and Components</td>
<td>12</td>
<td>1.9%</td>
<td>3.2%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Banks</td>
<td>338</td>
<td>1.8%</td>
<td>2.4%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Capital Goods</td>
<td>107</td>
<td>0.3%</td>
<td>2.0%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Commercial and Professional Services</td>
<td>48</td>
<td>0.4%</td>
<td>1.2%</td>
<td>7.0%</td>
</tr>
<tr>
<td>Consumer Durables and Apparel</td>
<td>116</td>
<td>2.2%</td>
<td>6.4%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>68</td>
<td>2.8%</td>
<td>7.3%</td>
<td>14.8%</td>
</tr>
<tr>
<td>Diversified Financials</td>
<td>65</td>
<td>1.5%</td>
<td>3.3%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Energy</td>
<td>4</td>
<td>2.6%</td>
<td>4.8%</td>
<td>6.8%</td>
</tr>
<tr>
<td>Food and Staples Retailing</td>
<td>13</td>
<td>0.4%</td>
<td>0.5%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Food, Beverage and Tobacco</td>
<td>67</td>
<td>2.0%</td>
<td>4.7%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Healthcare Equipment and Services</td>
<td>112</td>
<td>2.2%</td>
<td>15.9%</td>
<td>29.2%</td>
</tr>
<tr>
<td>Household and Personal Products</td>
<td>31</td>
<td>9.0%</td>
<td>11.9%</td>
<td>23.5%</td>
</tr>
<tr>
<td>Insurance</td>
<td>6</td>
<td>1.3%</td>
<td>2.1%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Materials</td>
<td>35</td>
<td>0.7%</td>
<td>2.7%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Media</td>
<td>31</td>
<td>1.4%</td>
<td>4.4%</td>
<td>12.9%</td>
</tr>
<tr>
<td>Pharmaceuticals, Biotechnology and Life Sciences</td>
<td>32</td>
<td>2.9%</td>
<td>9.2%</td>
<td>19.6%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>6</td>
<td>1.7%</td>
<td>4.9%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Retailing</td>
<td>117</td>
<td>1.5%</td>
<td>3.6%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Semiconductors and Semiconductor Equipment</td>
<td>43</td>
<td>0.6%</td>
<td>6.3%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Software and Services</td>
<td>223</td>
<td>13.5%</td>
<td>22.9%</td>
<td>34.7%</td>
</tr>
<tr>
<td>Technology, Hardware and Equipment</td>
<td>156</td>
<td>3.8%</td>
<td>11.9%</td>
<td>21.7%</td>
</tr>
<tr>
<td>Telecommunication Services</td>
<td>39</td>
<td>1.7%</td>
<td>4.4%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Transportation</td>
<td>28</td>
<td>1.5%</td>
<td>3.8%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Utilities</td>
<td>5</td>
<td>0.2%</td>
<td>3.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Total</td>
<td>1742</td>
<td>1.8%</td>
<td>4.5%</td>
<td>15.2%</td>
</tr>
</tbody>
</table>

One of the most interesting aspects of Exhibit 2-5 is how strongly the Marketing-to-Sales statistics correlate to the R&D-to-Sales statistics. That is, industries with high R&D-to-Sales also tend to have high Marketing-to-Sales.

There is a very good economic reason for this. Specifically, technology intangibles and customer-based or marketing-related intangibles are “complements,” rather than substitutes. Technology is more valuable, the more valuable are customer-based intangibles. Correspondingly, customer-based intangibles are more valuable, the more valuable are a firm’s technology intangibles. It therefore makes sense that the firms with the highest R&D spending also tend to have the highest marketing-related spending.

Another interesting lesson from Exhibit 2-5 is that there is more variance across the Marketing-to-Sales ratios than there is across the median R&D-to-Sales ratios.
It turns out that this is true both on a cross-sectional basis (at a point in time across industries) and when measured on a time series basis (within an industry over time). In general, R&D investments tend to be more defined and constant, both across industries and across time, than marketing.

IV. How Much Residual Profit Do Firms Earn?

How much residual profit do firms realize, and how does this vary through time? Exhibits 2-6, 2-7, and 2-8 were developed in order to shed light on this question.

Exhibits 2-6 through 2-8 each show an 11 year time series for four residual profit definitions, for a different industry. Specifically, the exhibits show steady state gross residual profit, current period net residual profit, accrual net residual profit, and economic net residual profit. Exhibit 2-6 shows the eleven year time series for the automotive industry, 2-7 for the banking industry, and 2-8 for the capital goods manufacturing industry. The reader will note that these are the first three industries listed in Exhibits 2-4 and 2-5.

The calculations underlying Exhibits 2-6 through 2-8 rely on the following assumptions.

- \( I \) is comprised of reported R&D and Sales & Marketing expense.
- R&D is assumed to have a 5 year economic life, and a one year gestation lag, for all firms.
- Sales & Marketing is assumed to have a 2 year economic life, and a 6 month gestation lag, for all firms.
- R&D investment is assumed to have a required rate of return of 25 percent, for all firms.
- Sales & Marketing investment is assumed to have a required rate of return of 20 percent, for all firms.

These exhibits were developed using the CapitalIQ database.\(^{23}\) The corresponding exhibits for the other industry classifications within CapitalIQ are provided in the Excel™ files that accompany this book.

\(^{23}\) Exhibit 2-6 is supported by data for 7 companies, 2-7 by data for 58 companies, and 2-9 by data for 61 companies.
Exhibit 2-6
Net and Gross Residual Profit: Automotive Industry
2000-2010
Exhibit 2-7
Net and Gross Residual Profit: Banking Industry
2000-2010
Upon examination, a number of points regarding Exhibits 2-6 through 2-8 merit mention. First, not surprisingly, the automotive industry earns, on average, zero economic profit. This is an industry that is famous for its competitiveness, and our data bear out the conclusion that the invested capital base for this industry, including IDCs in that definition, just earns its required rate of return.

Second, it is also unsurprising that the banking sector also earned approximately its cost of capital during the past decade, with the exception of the two post-bubble recessions (the dotcom and housing bubbles). This is not surprising simply because banks borrow at a competitive cost of capital, and lend or invest at a competitive cost of capital. The result is, almost by definition, a return roughly equal to the industry’s required return.
Third, the banking sector shows gross and net residual profit that are quite close to one another. This is the result of low investments in intangible assets. Banks invest very little in R&D, and for that matter Sales & Marketing.

Finally, the capital goods manufacturing sector showed relatively healthy economic (and current and accrual) net residual profit over the 2000-2010 period. This is largely the result of the supply constraints faced by that sector as globalization produced massive demand for capital goods in emerging markets.

The overriding lesson, however, of all three exhibits is the same as that of the other exhibits contained in the accompanying Excel™ files. Namely, over the long run, not much net residual profit is earned. Markets tend to be fairly competitive in many industries, resulting in low economic net residual profits across most time periods.

V. Accompanying Excel Files

The Excel files accompanying this book include a file entitled “[TITLE].” The purpose of [TITLE] is to provide the reader with a working model that allows him or her to apply the concepts contained in this chapter.

The reader will find that this file includes the following sheets. [IAN TO INSERT. BASICALLY DISCUSS ALL SHEETS IN YOUR TEMPLATE, USE ONE BULLET POINT PER SHEET, AND THEN INSERT A DISCUSSION AT THE BOTTOM OF THE BULLETS (IF APPROPRIATE)].

- [INSERT]

We hope that the reader will find [TITLE] to be useful. Questions and comments are welcome, and can be addressed to timothy.reichert@gmail.com or icgray@gmail.com.
Appendix 2-A

The purpose of this appendix is to describe the mathematical relationships between net and gross returns to a given capital asset type or category. This asset category can be the firm’s entire non-routine intangible capital base, its routine invested capital base, or a single asset of either type.

The primary result developed here is as follows: **in a steady state equilibrium** the present value of net profits (net of capital depreciation) forecasted **into perpetuity** – meaning, forecasted over all future generations of the same asset category – will equal the present value the gross profits (operating profit plus depreciation) of a **single generation** of the same asset type. Said differently, we show that the cash flows (operating profit plus the “add back” of depreciation) over the economic life of a single generation of the asset or asset category will equal the present value of the operating profit (which is net of depreciation) over all successive generations into perpetuity.

There are two reasons that this result is important for finance professionals who perform asset valuations. First, the mathematics given here will hopefully make it easier for valuation professionals to ensure that they are properly matching income streams and time horizons. We sometimes see valuations that involve the present valuation of profits that are net of depreciation over the finite life of the asset being valued.

Second, and much more importantly, the result developed here “reconciles” valuation approaches that employ a perpetual time horizon with those that employ a finite time horizon. Much confusion, in our experience, exists around whether or not intangible asset valuation methods that employ perpetual time horizons – such as the relief from royalty method – are consistent in their assumptions with other methods that conceive of intangible assets as finite lived. We show that perpetual methods involving profits net of depreciation are completely reconcilable to finite horizon methods involving the gross profits (cash flows after adding back depreciation) of a single generation of the same asset category.

To begin, we express the present value of a perpetual flow of operating profit, net of the depreciation of capital in each period, as follows:

\[
V = \int_0^\infty \pi e^{-rt}e^{\theta t}dt = \int_0^\infty \pi e^{-r+(\theta-\pi)t}dt,
\]

(Formula 2A-1)
where $V$ is present value, $r$ is the discount rate applicable to $\pi$, and $g$ is the growth rate. Upon integration, we have:

(Formula 2A-2) \[ V = \frac{\pi}{r-g} \]

which is the standard present value formula, in continuous time, of a stream of income growing at $g$ into perpetuity.

We can think of Formula 2A-2 as modeling the present value of the operating profit, net of depreciation, of the asset category of interest. Formula 2A-2 is thus capturing the present value of the operating profit associated with the asset category over multiple successive generations, extending into perpetuity.

The question now is whether or not there is a condition under which the value obtained in Formula 2A-2, or $V$, is equal to the value that one would obtain if one took the present value of the operating profit flow (net of the depreciation of capital) from only one generation of the same asset category. To answer this, we first have to take the present value of the profit stream generated by one generation of the asset category of interest. This is given in Formula 2A-3, below.

(Formula 2A-3) \[
V = \int_0^T \bar{\pi} e^{-rt} e^{gt} dt = \int_0^T \bar{\pi} e^{-(r-g)t} dt.
\]

Formula 2A-3 looks identical to Formula 2A-1, except that the time horizon now extends only to $T$, which we assume to be the economic life of one generation of the asset category. Although we assume that Formula 2A-3 is discounting the same level of operating profit, $\pi$, in each period as is Formula 2A-1, we nonetheless denote the profit level for a finite lived asset as $\bar{\pi}$, in order to remind us that we are examining the profit flow from a single generation (finitely lived) of the asset category. Formula 2A-3 can be integrated to yield the following:

(Formula 2A-4) \[
\bar{V} = \frac{\bar{\pi}}{r-g} (1 - e^{-(r-g)T}).
\]

Formula 2A-4 is structurally very similar to the formula for the present value of a perpetuity, except that the term $\frac{\bar{\pi}}{r-g}$ is reduced due to its multiplication by the second term on the right hand side, or $\left(1 - e^{-(r-g)T}\right)$, which is a fraction that is less than one.
Although it is not at all obvious at first, Formula 2A-4 is saying that $\tilde{V}$ (the present value of the operating profit, net of depreciation, of the asset category over one generation) is less than $V$ (the present value of the operating profit of the asset category into perpetuity) by an amount that is exactly equal to the present value of the per period depreciation of the asset into perpetuity. To see this, we first find the derivative (rate of change) of $\tilde{V}$ with respect to $t$, which is equal to the depreciation rate of $\tilde{V}$. Taking the derivative of Formula 2A-4 with respect to $t$, we have:

(Formula 2A-5) \[ \frac{\partial \tilde{V}}{\partial t} = \bar{\pi} e^{-(r-g)t}. \]

Thus, the rate of depreciation of $\tilde{V}$ is equal to $\bar{\pi} e^{-(r-g)t}$. It bears noting that Formula 2A-5 is very general, encompassing both positive growth rates, $g$, and rates of decay, $-g$.

Given this, it is easy to see from inspection of Formula 2A-4 that $\tilde{V}$ is less than $V$ by an amount equal to $\pi \left( e^{-(r-g)t} \right)$, which is just the present value, taken into perpetuity, of the depreciation of the asset category over all future generations.

Logically, this means that $\tilde{V}$, or the present value of the profit flow from one generation of the asset category, will equal $V$, the present value of the profit flow from all future generations of the same asset category, if we add depreciation to $\pi$. Said differently, this means that gross returns (net plus depreciation), or cash flows, over one generation of the asset category is equal to the present value of net operating profit into perpetuity (over an infinite succession of assets of the same category).

This is a very important result for us. Why? Because it tells us that we can value an asset in two equivalent ways. First, we can value the asset on a “net” basis – using a perpetual “life” or time horizon. Alternatively, we can value the asset on a “gross,” or “cash flow” basis – looking only at the cash flows from the currently existing generation of the asset.

There is another implication of this that we will exploit as well. As noted earlier in this chapter, an implication of this result is that, for forecasting purposes, the operating profit (net of depreciation) that is attributable to a given asset category is equal to the current asset value, $V$, times $(r-g)$ in period 1, grown by $g$ thereafter. This can be readily seen from Formula 2A-2, which we now know values the current generation of a given asset category. Simple cross
multiplication tells us that \( \pi \) in the next period is simply equal to \( V \) times \( (r-g) \). And, since we have assumed in Formula 2A-1 that the profit stream is growing by \( g \), it must be the case that \( V(r-g) \), or first period \( \pi \), grows by \( g \) thereafter.