

The Role of Growth Options and Intangible Assets in Valuation: The Case of Alphabet

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When attempting to gain insight into the valuation of a company, there are three important distinctions to bear in mind: **(1)** the difference between book and market values, **(2)** the difference between the value of the tangible capital that appears on the balance sheet and the value of the internally generated intangibles that do not, and **(3)** the difference between the value of assets in place and the value of growth options. Here we examine these distinctions using the example for Alphabet, a company for which intangibles and growth options are a critical source of value.

The three distinctions are not only important in their own right but can have a large impact on measures of profitability. In this paper, we focus on the return on equity, but the analysis presented can be extended to virtually any other measure of profitability.

The first thing to recognize is that both intangibles and growth options are typically valued as residuals. In the case of internally generated intangibles, their valuation is generally based on a comparison between the book and market value of a company's equity. Similarly, the value of growth options is usually calculated by subtracting an estimate of the equity value of the assets in place from the total market value of the equity.

The best way to illustrate the calculations and the associated issues is by working through the example of Alphabet. In doing so, the goal is to highlight the important concepts, not argue about the precise estimates. For example, a debate still rages in finance about how to estimate the cost of equity capital. Here that debate is set aside and the basic CAPM is used

That is not meant to imply that the basic CAPM is the right solution, but only that it leads to a reasonable ballpark number for Alphabet. The same logic is applied to other issues such as the precise procedure used to estimate the value of assets in place.

To get started, the relevant balance sheet data for Alphabet are presented in Exhibit 1. The exhibit shows that as of September 30, 2018 Alphabet had a total book equity value of \$169.8 billion. In comparison, the market value of the equity was \$832.3 billion. As shown in the exhibit, the internally generated intangibles are valued as a residual. Their market value equals the difference between the book value of equity and market value of equity, or \$662.5 billion. The last block of entries in Exhibit 1 can be ignored for now. The role of the those entries will become clear below.

Exhibit 1: Balance Sheet Items and Market Value for Google as of September 30, 2018

(in millions)	Book value	Market value
Cash and short-term investments	106,416	106,416
Net working capital and other net short-term assets	(4,533)	4,375
Property, plant and equipment and long-term investments	67,973	67,973
Goodwill and other acquired intangibles	20,343	20,343
Debt (long-term and short-term)	(3,948)	(3,948)
Other long-term liabilities	(16,411)	(16,411)
Book equity	169,840	
Market value of equity		832,297
Market value of intangible assets		662,457
Internally generated intangibles with no core	88,530	662,457
Internally generated intangibles with core intangible	224,866	662,457
Adjusted book equity no core	258,370	
Adjusted book equity with core	394,706	

The foregoing residual calculation assumes that the book value of the items that are on the balance sheet equals their market. That is not likely to be the case, at least not precisely. Numerous authors, such as Holthausen and Zmijewski (2018), have produced a checklist of reasons why book and market values will diverge for at least some tangible assets. These include the failure of accounting depreciation to reflect economic depreciation, the failure to properly account for inflation, and the addition of special accounts such as deferred taxes, among other things. In addition to these well-known issues, there is another subtler reason why book and market values could diverge. To the extent that the tangible assets are not “off the shelf items,” they also could incorporate an intangible element. For example, a specialty server constructed by a company may be worth more than the cost of producing it. Taken as a whole, however, these considerations typically are going to be second order compared to the impact of excluding internally generated intangibles. Therefore, for the remainder of this paper, I assume that they can be ignored.

Exhibit 1 highlights the importance of intangibles for Alphabet. The intangibles account for 80% of Alphabet’s market capitalization. While intangible assets are particularly important in the case of Alphabet, Alphabet is by no means unique. Lev (2016) observes that over the last forty years intangible assets have accounted for an increasing fraction of the value of American companies and the investments made by American firms. He reports that between 1977 and 2014 investment in physical assets fell by 35 percent, whereas investment in intangible assets rose by 60 percent.

The residual calculation in Exhibit 1 gives the market value of the intangible assets. If one the goals is assessing the impact of intangible assets on measures of profitability, then, as Damodaran (2007) stresses, it may be more appropriate to use the amount invested in intangibles rather than their current market value. For instance, a firm that creates a valuable brand name with relatively small investments in advertising will not be credited with the high return on equity it “deserves” if the market value of the brand is added to an adjusted balance sheet. Instead, what Damodaran, along with many others, recommends doing is capitalizing and amortizing those expenses, such as advertising and research and development, that are better classified as investments.

In case of Alphabet, the recommended procedure begins with the income statement data provided in Exhibit 2. The data are annualized by taking the quarterly income statement as of September 30 and multiplying all the items by four.

Exhibit 2: Annualized (4x) September 30, 2018 Income Statement

(in millions)	Book value
Revenue	134,960
Cost of revenue	57,124
Gross profit	77,836
Research and development	20,928
SG&A	23,668
Operating income	33,240
Other income	7,092
EBIT	40,332
Income tax expense	3,564
Net income	36,768
Effective Tax Rate	8.84%

Given the income statement data, the question is what to capitalize? There is no general answer to that question. It depends on an understanding of the business of the company in question. My choice for Alphabet is 1.25 times the research and development expense. The factor of 1.25 is used to account for the fact that there are probably other items hidden within SG&A, such as marketing and promotion, that should be capitalized.

The process of capitalization is presented in Exhibit 3. The first requirement is choosing a depreciable life and a depreciation schedule for the capitalized intangible investments. For the example, the intangible investments are assumed to have a ten-year life and depreciate straight line. Consequently, ten years of historical data are required to calculate total depreciation and the unamortized stock of intangible capital. The research and development expenditures for years prior to 2018 are taken from historical income statements and multiplied by 1.25 to arrive at the annual investment in intangibles. As shown in Exhibit 3, the unamortized portion of the investment in intangibles is \$88.5 billion. This number

is also added to the bottom of Exhibit 1 and used to calculate the adjusted book value shown there. The amortization for 2018 is \$12.30 billion which is used when the income statement is adjusted. Notice that the “book value” of the intangible capital using this approach of \$88.5 billion is only about 13% of the market value of intangibles of \$662.5 billion.

Exhibit 3: Capitalization of Intangible Expenses

As of June 2018, in millions	Intangible investment (1.25*R&D)	Amortization	Unamortiz ed portion	Current Amortization	
2018	26,160	1.00	26,160		21,800.00
2017	20,781	0.90	18,703	2,078	17,317.71
2016	17,435	0.80	13,948	1,744	14,529.17
2015	15,353	0.70	10,747	1,535	12,793.75
2014	12,290	0.60	7,374	1,229	10,241.67
2013	9,940	0.50	4,970	994	8,283.33
2012	8,491	0.40	3,397	849	7,076.04
2011	6,453	0.30	1,936	645	5,377.08
2010	4,703	0.20	941	470	3,918.75
2009	3,554	0.10	355	355	2,961.49
2008	3,491	0.00	0	349	2,909.58

Net Investment in intangibles	88,530
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Amortizaion for 2018	10,249
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Although the foregoing approach is widely used for capitalizing intangibles, it has a carry over from the treatment of tangible assets that may be questionable. In particular, it equates the stock of intangible assets with the unamortized portion of relatively recent investment. But that does not seem to make sense in the case of Alphabet. Many of the company's recent research and development efforts have not been fruitful and virtually all its profits are due to its original search technology, although that technology has been refined and enhanced by more recent investments. This is not a condition unique to Alphabet. For instance, Coca-Cola still relies on a brand name developed more than a century ago. The problem is how to take account of such long-lived, core, intangible assets.

One way to solve the problem is to assume that rather than undergoing normal amortization the core intangible assets have uniquely long lives if they are maintained and enhanced with ongoing investment. With respect to Alphabet, as long as the company engages in enough research and development to maintain its competitive edge in search, the core technology and the investments dedicated to it depreciate far more slowly than other run-of-the-mill research and development investments.

Exhibit 4 illustrates a possible method of accounting for the role of core intangibles in the case of Alphabet. The idea is that at some point in the past what can be called new Alphabet had to purchase the core technology from old Alphabet. New Alphabet would then make investments to refine and enhance the core capital it had "purchased" from old Alphabet by issuing new equity. To estimate the amount of core capital purchased, I begin with data from 2007. In that year, Alphabet had an equity book value of \$23 billion and a market value of \$217 billion, so that the market value of the intangibles was \$194 billion. Of that, I assume that \$150 billion is represented by the core intangible. In Exhibit 4, it is assumed that the core intangible depreciates at 2% per year. The final issue is dividing the annual intangible investments into those expenditures dedicated to maintaining and enhancing the core technology, and which therefore depreciate at the same speed as the core, and other investments that are amortized straight-line over ten years as shown in Exhibit 3. Exhibit 4 assumes that the division is fifty-fifty.

Given the foregoing assumptions, the amortization schedules are presented in Exhibit 4. Because of the incorporation of the core intangible and slow its depreciation, the book value of intangibles rises to \$224.9 billion. This figure is added to Exhibit 1 and used to compute the adjusted book value including the core intangible. Because of the slower depreciation of the core intangible, the amortization for 2018 falls to \$8.5 billion.

Exhibit 4: Intangibles Capital Stock and Amortization

Amortization rate (new spend) = 10.0% linear
 Amortization rate (core) = 2.0% percentage
 Percentage of new investment in core = 50%

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Intangible Investment	3,492	3,554	4,703	6,453	8,492	9,940	12,290	15,353	17,435	20,782	26,160

												Value of Core Intangible	Total Intangible Capital	
Calculations for investment in the core														
2007	150,000												150,000	150,000
2008	147,000	1,746											148,746	150,492
2009	144,060	1,711	1,777										147,548	150,896
2010	141,179	1,677	1,742	2,351									146,948	152,296
2011	138,355	1,643	1,707	2,304	3,226								147,236	155,222
2012	135,588	1,610	1,673	2,258	3,162	4,246							148,537	159,859
2013	132,876	1,578	1,639	2,213	3,098	4,161	4,970						150,536	165,493
2014	130,219	1,547	1,606	2,169	3,037	4,078	4,871	6,145					153,670	172,941
2015	127,614	1,516	1,574	2,125	2,976	3,996	4,773	6,022	7,676				158,273	182,774
2016	125,062	1,485	1,543	2,083	2,916	3,916	4,678	5,902	7,523	8,718			163,825	193,830
2017	122,561	1,456	1,512	2,041	2,858	3,838	4,584	5,784	7,372	8,543	10,391		170,939	207,249
2018	120,110	1,426	1,482	2,000	2,801	3,761	4,492	5,668	7,225	8,372	10,183	13,080	180,601	224,866
Amort	2,451	29	30	41	57	77	92	116	147	171	208	0	3,419	

												Value of other Intangibles	Total Amort	
Calculations for other investments														
2007														
2008		1,746											1,746	8,543
2009		1,571	1,777										3,348	
2010		1,397	1,599	2,351									5,347	
2011		1,222	1,422	2,116	3,226								7,986	
2012		1,048	1,244	1,881	2,904	4,246							11,322	
2013		873	1,066	1,646	2,581	3,821	4,970						14,957	
2014		698	889	1,411	2,258	3,397	4,473	6,145					19,271	
2015		524	711	1,176	1,936	2,972	3,976	5,531	7,676				24,501	
2016		349	533	941	1,613	2,548	3,479	4,916	6,909	8,718			30,005	
2017		175	355	705	1,291	2,123	2,982	4,302	6,141	7,846	10,391		36,310	
2018		0	178	470	968	1,698	2,485	3,687	5,373	6,974	9,352	13,080	44,265	
Amort	0	175	178	235	323	425	497	615	768	872	1,039	0	5,125	

Attempting to distinguish core intangibles from recent intangible investments could be dismissed as an academic quibble were it not so important for estimating the return on equity and other measures of profitability. Exhibit 5 presents calculation of the return on equity for Alphabet using three different definitions of ROE: (1) the traditional accounting definition; (2) an adjusted accounting definition that capitalizes R&D spending as was done in Exhibit 3; and (3) a definition of ROE that distinguishes between core intangibles and recent intangible investments as developed in Exhibit 4. In each case, the income statement is adjusted by adding back the expensed investment in intangibles. Because intangible investment is 1.25 R&D, the R&D expense is reduced to zero and the remaining add back is incorporated into SG&A. The amortized expense is then deducted. It is assumed in Exhibit 5 that the amortized expense is tax deductible.

Exhibit 5: Return On Equity

	Traditional ROE Calculation	Intangible Adjustment without core	Intangible adjustment with core
Gross profit	77,836	77,836	77,836
Research and Development	20,928	-	
SG&A	23,668	18,436	18,436
EBIT	36,768	59,400	59,400
Intangible investment added back	-		
Amortization of intangibles		10,249	8,543
EBIT	40,322	49,151	50,857
Tax expense at 8.84%	3,564	4,345	4,496
Net Income	36,768	44,806	46,361
Book equity	169,840		
Adjusted book equity without core intangible		258,370	
Adjusted book equity with core intangible			394,706
Return on Equity (ROE)	21.6%	17.3%	11.7%

The impact of the differing treatment of intangibles on ROE is pronounced. Without any adjustment, the return on equity is 21.7% for Alphabet. The ROE falls to 17.3% when the last ten years of expenditures are capitalized. It then drops all the way to 11.7%, close to the cost of capital, when an adjustment is made to account for the core intangible.

The foregoing should not be interpreted to imply that the way I handled the core intangible is “correct,” even in the specific case of Alphabet. The proper way to handle the core intangible depends on a detailed understanding of the business in question. For instance, in the case of Coca-Cola, Damodaran (2009) recommends capitalizing and depreciating selling and advertising expenditures over at least 25 years to capture the value of the Coke’s core intangible, namely its brand name. The point is to illustrate that failing to recognize the existence of a core intangible may lead to a fundamental misunderstanding of the profitability of a business and a corresponding error in the valuation of that business.

Turning to growth options, as defined originally by Myers (1977) growth opportunities, or growth options, are *“best regarded as the present value of the firm’s options to make future investments. The distinction being drawn here is between assets whose ultimate value depends on further, discretionary investment by the firm, and assets whose ultimate value does not depend on such investment.”* Myers then divides the total value of the firm into two parts: the value of the assets in place and the value of the growth options. He does not attempt to describe how either is to be calculated. However, subsequent research has made it clear that the only reasonable way to value growth options is as a residual. Growth options are whatever is left over after the value of assets in place is deducted from the market value.

Before turning to the calculations, it is worth asking where the growth options come from in the first place. There must be something about the firm, as it exists today, that is responsible for creating the growth options. Because most tangible assets can be purchased in the market, that “something” must be the intangible capital. To be sure, the precise intangible assets that create the growth options may be difficult to identify. For instance, the growth options might be related to more nebulous intangibles such as the organizational structure of the company or the skills of the employees. Nonetheless, it remains the case that the source of growth options must be intangible capital. This implies that the value of the growth options should be less than the value of the intangible assets because, in addition to creating growth options, intangibles also enhance current earnings leading to an increase in the value of assets in place. It also implies that it is a mistake to say that the market value of a company like Alphabet is due in large part to intangibles *and* growth options. This makes it sound like there are two things that when added together enhance the value of the company. Such thinking can lead to double counting. The growth options exist because of intangible assets, so estimates of the two should not be added together.

There a host of possible ways to compute the values of asset in place. For instance, consulting firm Charles River Associates uses a method that includes five years of projected income in the calculation. Here I use the simplest approach. It is also the approach that is likely to lead to a low estimate of the value of assets in place and, thereby, a large estimate of the value of growth options. Specifically, I estimate the value of assets in place as by assuming it equals the present value of current earnings grown in perpetuity at the rate of inflation. For this calculation the rate of inflation is assumed to be 2%. The present value is calculated using a cost of equity of 11% for Alphabet, derived from an application of the standard CAPM and rounded to the nearest percent. As shown in the Exhibit 6, the equity value of the assets in place comes to \$408.5 billion. Deducting that amount from the market value of equity gives a residual value for the growth options of \$423.8 billion. Notice that the value of the growth options is less than the value of the intangibles. Although the calculations are rough, this consistent with the view that that the value of growth options is less than the value of the intangibles that produce them.

Exhibit 6: Estimating the value of Growth Options

(in millions)	Book value
4x September 30 quarterly net income from Exhibit 2	36,768
Inflation rate	2.00%
Estimate cost of equity capital	11.00%
Equity value of assets in place	408,533
Equity market value	832,297
Value of growth options	423,764

In conclusion there are three main takeaways from the analysis.

- Intangible assets and related growth options represent an increasing fraction of the market capitalization of companies worldwide. In the case of Alphabet, intangibles account for about 80% of the equity market value.

- Intangible assets and growth options are not separate components of value that can be added.

Growth options are produced by intangible assets, although the manner in which this occurs may be very difficult to determine.

- Failure to adjust the balance sheet and income statement to take account of intangible investments can lead to a **misleading estimates of profitability and biased valuations**. However, there is no hard and fast rule for making the necessary adjustments. It depends not only on the depreciation schedule for intangible investments, but also on whether there are core intangibles that require special treatment. Both, in turn, will vary depending on the specific nature of the business being analyzed.

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