# A Sanity Test When Estimating Capital Expenditures in Excess of Depreciation

*by Brant H. Armentrout, CFA*

While business appraisers and financial analysts examine in great detail the cost of capital and expected revenue growth rates, the investment in capital expenditures required in excess of depreciation is sometimes an afterthought when calculating value using the capitalized cash flow and discounted cash flow methodologies. The calculation of this investment is an important determinant of free cash flow. An estimate that assumes capital expenditures are equal to depreciation expense in perpetuity may severely overestimate value, especially if the subject company has a high growth rate and/or a high percentage of Net Property, Plant and Equipment ("Net P, P & E") / Total Assets. This article provides a model that can be used as a "sanity test" when estimating capital expenditures in excess of depreciation in perpetuity. In addition, the article summarizes depreciation methods and the treatment of leases under GAAP and tax, lists ways to estimate capital expenditures and average depreciable lives, and illustrates the constant relationship of capital expenditures to shipments in the U.S. manufacturing sector from 1977-2001.

The calculation of free cash flow using an Invested Capital approach can be summarized as:

Earnings before Interest and Taxes ("EBIT")

–

Normalized Taxes Applied to EBIT

–

Investment in Working Capital

–

Investment in Capital Expenditures in Excess of Depreciation

=

**Free Cash Flow (Invested Capital)**

Most businesses require an investment in capital assets, be it real estate, production equipment, vehicles, computers or many other items. New capital assets are needed to: (1) replace existing assets that are no longer useful; (2) augment existing assets; and/or (3) increase revenue and/or production capacity.

When estimating capital expenditures required in excess of depreciation expense, the two main determinants of this difference are: (1) growth rates; and (2) average depreciable life of assets. I will present the model below, followed by a discussion of my assumptions and other issues that must be considered when estimating this difference.

I have assumed that a hypothetical company spends $20,000 on capital expenditures in its first year, with depreciation expense calculated using a half-year, straight-line convention. Net P, P, & E / Total Assets remains constant at 20 percent at the end of each year, with a return on end-of-year assets held at 10 percent. After initial high growth rates, the company slows to a constant terminal growth rate of five percent in year six. The forecast is continued using the same growth rate until the percentage of depreciation/capital expenditures stabilizes. The chart below illustrates the calculation of this percentage using a terminal growth rate of five percent and an average depreciable life of seven years.

## TABLE ONE

| | |
|---|---|
| Depreciation / Cap Ex. Perpetuity Percentage | 84.7% |
| Average Depreciable Life | 7 Years |
| Growth Rate in Perpetuity | 5% |

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Year 13 | Year 14 | Terminal Year 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gross Property and Equip. | 20,000 | 48,000 | 84,400 | 128,080 | 176,128 | 226,578 | 279,551 | 335,173 | 393,576 | 454,898 | 519,287 | 586,896 | 657,884 | 732,423 | 810,688 |
| Less: Acc. Depreciation | 1,429 | 6,286 | 15,743 | 30,920 | 52,649 | 81,414 | 117,566 | 160,046 | 207,243 | 258,391 | 312,798 | 370,082 | 430,230 | 493,386 | 559,699 |
| Net Property and Equipment | 18,571 | 41,714 | 68,657 | 97,160 | 123,479 | 145,165 | 161,985 | 175,127 | 186,333 | 196,508 | 206,489 | 216,813 | 227,654 | 239,037 | 250,989 |
| Total Assets | 92,857 | 208,571 | 343,286 | 485,800 | 617,394 | 725,823 | 809,927 | 875,633 | 931,665 | 982,538 | 1,032,445 | 1,084,067 | 1,138,270 | 1,195,184 | 1,254,943 |
| Net Income | 9,286 | 20,857 | 34,329 | 48,580 | 61,739 | 72,582 | 80,993 | 87,563 | 93,166 | 98,254 | 103,244 | 108,407 | 113,827 | 119,518 | 125,494 |
| Net P,P, & E/ Total Assets | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% |
| Return on Assets | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| Growth Rate | | 40% | 30% | 20% | 10% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 | Year 10 | Year 11 | Year 12 | Year 13 | Year 14 | Year 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital Expenditures | 20,000 | 28,000 | 36,400 | 43,680 | 48,048 | 50,450 | 52,973 | 55,622 | 58,403 | 61,323 | 64,389 | 67,608 | 70,989 | 74,538 | 78,265 |
| Depreciation - Year 1 | 1,429 | 2,857 | 2,857 | 2,857 | 2,857 | 2,857 | 2,857 | 1,429 | | | | | | | |
| Depreciation - Year 2 | | 2,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 2,000 | | | | | | |
| Depreciation - Year 3 | | | 2,600 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 5,200 | 2,600 | | | | | |
| Depreciation - Year 4 | | | | 3,120 | 6,240 | 6,240 | 6,240 | 6,240 | 6,240 | 6,240 | 3,120 | | | | |
| Depreciation - Year 5 | | | | | 3,432 | 6,864 | 6,864 | 6,864 | 6,864 | 6,864 | 6,864 | 3,432 | | | |
| Depreciation - Year 6 | | | | | | 3,604 | 7,207 | 7,207 | 7,207 | 7,207 | 7,207 | 7,207 | 3,604 | | |
| Depreciation - Year 7 | | | | | | | 3,784 | 7,568 | 7,568 | 7,568 | 7,568 | 7,568 | 7,568 | 3,784 | |
| Depreciation - Year 8 | | | | | | | | 3,973 | 7,946 | 7,946 | 7,946 | 7,946 | 7,946 | 7,946 | 3,973 |
| Depreciation - Year 9 | | | | | | | | | 4,172 | 8,343 | 8,343 | 8,343 | 8,343 | 8,343 | 8,343 |
| Depreciation - Year 10 | | | | | | | | | | 4,380 | 8,760 | 8,760 | 8,760 | 8,760 | 8,760 |
| Depreciation - Year 11 | | | | | | | | | | | 4,599 | 9,198 | 9,198 | 9,198 | 9,198 |
| Depreciation - Year 12 | | | | | | | | | | | | 4,829 | 9,658 | 9,658 | 9,658 |
| Depreciation - Year 13 | | | | | | | | | | | | | 5,071 | 10,141 | 10,141 |
| Depreciation - Year 14 | | | | | | | | | | | | | | 5,324 | 10,648 |
| Depreciation - Year 15 | | | | | | | | | | | | | | | 5,590 |
| Total Depreciation Expense | 1,429 | 4,857 | 9,457 | 15,177 | 21,729 | 28,765 | 36,152 | 42,480 | 47,196 | 51,148 | 54,408 | 57,284 | 60,148 | 63,156 | 66,313 |
| Accumulated Depreciation | 1,429 | 6,286 | 15,743 | 30,920 | 52,649 | 81,414 | 117,566 | 160,046 | 207,243 | 258,391 | 312,798 | 370,082 | 430,230 | 493,386 | 559,699 |
| Depreciation / Cap. Ex. | 7.1% | 17.3% | 26.0% | 34.7% | 45.2% | 57.0% | 68.2% | 76.4% | 80.8% | 83.4% | 84.5% | 84.7% | 84.7% | 84.7% | 84.7% |

Using the same methodology, the following chart summarizes the percentage of depreciation/capital expenditures, using a variety of growth rates and average depreciable lives.

## TABLE TWO

## Estimated Percentage of Depreciation / Capital Expenditures in Perpetuity

| Terminal Growth Rate | Average Depreciable Life 3 Years | 5 Years | 7 Years | 10 Years | 15 Years | 20 Years |
|---|---|---|---|---|---|---|
| 2% | 97.1% | 95.2% | 93.4% | 90.7% | 86.5% | 82.6% |
| 3% | 95.7% | 93.0% | 90.3% | 86.6% | 80.8% | 75.5% |
| 4% | 94.4% | 90.8% | 87.5% | 82.7% | 75.6% | 69.3% |
| 5% | 93.0% | 88.8% | 84.7% | 79.1% | 70.9% | 63.9% |
| 6% | 91.8% | 86.8% | 82.1% | 75.8% | 66.7% | 59.1% |
| 7% | 90.5% | 84.9% | 79.7% | 72.7% | 62.8% | 54.8% |

Using the chart above, a company with a terminal growth rate of six percent and an average depreciable life on fixed assets of 15 years would be expected to have a percentage of deprecation/capital expenditures of 66.7 percent in perpetuity.

The major assumptions of the model are:

1) Net P, P & E to total assets remains constant;
2) Return on assets remains constant;
3) Depreciable assets have a salvage value of zero;
4) Depreciable lives equal actual lives;
5) Using the straight-line depreciation method approximates actual loss in value;
6) No asset sales;
7) The company does not have any intangible assets.

## Effect on Valuation

An incorrect estimate of the difference in capital expenditures and depreciation expense in perpetuity can have a dramatic impact on value. Using the previous example of a seven-year average depreciable life on fixed assets and a five percent growth rate, I have compared the value conclusion in the terminal (15th) year, using my model compared to a typical assumption of capital expenditures equal to depreciation in perpetuity. I have assumed no debt, revenues to working capital of 15.0 and a free cash flow multiple of 15.0.

**TABLE THREE**

### Valuation Example

| | Model | 100% |
|---|---|---|
| Net Income (Terminal Year) | $125,494 | $125,494 |
| Less: Investment in Working Capital | (4,183) | (4,183) |
| Less: Cap. Ex. in Excess of Depreciation | (11,952) | 0 |
| Free Cash Flow to Invested Capital | $109,359 | $121,311 |
| Free Cash Flow Multiple | 15.0 | 15.0 |
| Value of Invested Capital | $1,640,385 | $1,819,665 |
| Difference | | 10.9% |

As seen above, applying a typical assumption of capital expenditures equal to depreciation expense results in a 10.9 percent higher value conclusion than the value produced using the model.

Applying the model to a company with a higher growth rate and/or a greater percentage of Net P, P & E / Total Assets would result in greater percentage differences in value than the above example.

## Estimation of Capital Expenditures

When estimating the amount of capital expenditures, some of the items that should be considered are:

1) Current capacity percentage;
2) Historical relationship of capital expenditures to revenues;
3) Historical relationship of Net P, P & E to revenues;
4) Capital expenditures/revenues for the industry;
5) Future capital needs based on growth projections.

Estimating capital expenditures by using a constant percentage of Cap. Ex. / Revenues is a simple way to start a capital expenditures forecast. Survey data gathered by the U.S. Census Bureau on manufacturing establishments highlights the constant nature of this relationship, at least in the manufacturing environment.[1]

**TABLE FOUR**

| Year | Value of Shipments | Total Cap. Ex. | Total Cap. Ex. / Value of Shipments |
|---|---|---|---|
| **2001** | $3,970,499,812,000 | $143,651,531,000 | 3.62% |
| **2000** | $4,208,582,047,000 | $154,478,902,000 | 3.67% |
| **1999** | $4,031,884,590,000 | $150,325,065,000 | 3.73% |
| **1998** | $3,899,809,755,000 | $152,708,100,000 | 3.92% |
| **1997** | $3,834,700,920,000 | $151,510,757,000 | 3.95% |
| **1996** | $3,715,428,200,000 | $146,467,500,000 | 3.94% |
| **1995** | $3,594,359,600,000 | $134,318,100,000 | 3.74% |
| **1994** | $3,348,019,200,000 | $118,664,700,000 | 3.54% |
| **1993** | $3,127,620,400,000 | $108,628,500,000 | 3.47% |
| **1992** | $3,004,722,800,000 | $110,643,800,000 | 3.68% |
| **1991** | $2,878,164,800,000 | $103,152,900,000 | 3.58% |
| **1990** | $2,912,228,500,000 | $106,462,800,000 | 3.66% |
| **1989** | $2,840,376,000,000 | $101,894,300,000 | 3.59% |
| **1988** | $2,695,432,300,000 | $84,706,100,000 | 3.14% |
| **1987** | $2,475,939,100,000 | $85,662,100,000 | 3.46% |
| **1986** | $2,260,314,600,000 | $80,795,100,000 | 3.57% |
| **1985** | $2,280,183,800,000 | $91,244,900,000 | 4.00% |
| **1984** | $2,253,429,300,000 | $80,659,900,000 | 3.58% |
| **1983** | $2,045,853,300,000 | $67,479,800,000 | 3.30% |
| **1982** | $1,960,205,800,000 | $77,045,700,000 | 3.93% |
| **1981** | $2,017,542,500,000 | $83,767,000,000 | 4.15% |
| **1980** | $1,852,668,300,000 | $74,624,600,000 | 4.03% |
| **1979** | $1,727,214,600,000 | $65,796,600,000 | 3.81% |
| **1978** | $1,522,937,300,000 | $58,346,000,000 | 3.83% |
| **1977** | $1,358,526,400,000 | $51,907,300,000 | 3.82% |

| | |
|---|---|
| Median | 3.68% |
| Average | 3.71% |
| Minimum | 3.14% |
| Maximum | 4.15% |
| Standard Deviation | 0.24% |

Despite great technological innovation and a reduction in the total number of employees in the manufacturing industry in the U.S., the percentage of capital expenditures to revenues has remained relatively constant. The constant nature of this relationship is important when forecasting capital expenditures, illustrating that even a relatively mature industry like manufacturing still has to continually reinvest in fixed assets.

## Estimating Average Depreciable Lives

When estimating the average depreciable life of assets, some of the issues that should be considered:

1) Weighted depreciable life of all fixed assets currently on the balance sheet (exclude value of land);
2) Weighted depreciable life of all fixed assets with depreciation expense in the last year;
3) Expected depreciable life of assets needed for future growth and maintenance expenditures.

When examining the accuracy of the average depreciable life chosen, comparing the percentage of Net P, P, & E / Revenues in the forecast years with historical levels can illuminate poor inputs and/or prompt further questions.

## Tax vs. GAAP Depreciation

When estimating actual depreciation expense, it's important to distinguish between tax depreciation expense and GAAP (book) depreciation expense. GAAP requires companies to depreciate capital expenditures over their estimated useful lives using a systematic and rational allocation method, while tax laws require companies to depreciate the majority of capital expenditures using an accelerated method or the straight-line method over a prescribed recovery period. The difference in these depreciation calculations creates a temporary difference that reverses over time.

### GAAP

Companies may calculate depreciation for GAAP purposes using a variety of methods that allocate capital expenditures over their estimated useful lives. Depreciation begins when the capital expenditure is placed into service. In the first year, depreciation is prorated based on the month it is placed into service. Capital expenditures placed into service during the first half of a month are considered placed into service at the beginning of the month. Capital expenditures placed into service during the second half of a month are considered placed into service in the following month. Common depreciation methods used by companies for GAAP purposes are:

*Straight-Line* – The most commonly used depreciation method, and also the simplest. The cost of a fixed asset is depreciated in equal amounts over its estimated useful life.

*Double-Declining Balance* – A method of accelerated depreciation that is appropriate when the productivity of an asset is expected to be greater during its early years of use. Depreciation is calculated by multiplying the net book value of the asset times twice the straight-line rate.

*Sum of the Years' Digits (SYD)* –Similar to the double-declining balance method, the SYD method assumes a fixed asset loses a greater proportion of its value in the early years of use. Depreciation is calculated based on the number of years of remaining useful life. For an asset with a seven-year life, the denominator is 28 (1+2+3+4+5+6+7). In the first year, the numerator is 7, the second year is 6, and so on.

*Units of Production* – This method allocates depreciation expense based on actual physical usage. Assets with an indefinite life but a finite productive capacity are good candidates for this method. After purchasing the asset, an estimate of the total number of hours, products, miles and other measures (collectively "units") that the asset can be used in its lifetime is made. For each accounting period, the number of units used in that period is divided by the estimated total units for the asset's life to find the depreciation expense.

### Tax

For tax purposes, companies are required to depreciate a majority of capital expenditures using the modified accelerated cost recovery system (MACRS). Under MACRS, personal property, i.e. equipment, is depreciated using a declining-balance method over a prescribed recovery period. Companies may make an irrevocable election to use the straight-line method for personal property over the prescribed recovery period. MACRS requires companies to depreciate land and buildings (real property) using the straight-line method over a prescribed recovery period.

Depreciation may be taken for tax purposes when the capital expenditures are placed into service. In the first year, MACRS uses a half-year convention for personal property. The half-year convention considers all personal property placed into service at the mid-point of the year. Thus, all personal property receives a half-year of depreciation in the first year. The half-year convention switches to the mid-quarter convention if more than 40 percent of a company's annual capital expenditures are placed into service in the last quarter of the fiscal year. The mid-quarter convention considers all property placed into service at the mid point of the quarter. Thus, personal property placed into service in the fourth quarter will only receive a half of a quarter of depreciation in the first year. Personal property that is depreciated under the half-year convention will receive a half-year of depreciation in the year it is disposed of. Depreciation is calculated through the mid-point of the quarter of disposal for personal property depreciated under the mid-quarter convention.

Depreciation on real property begins on the mid-point of the month the real property is placed into service. This is known as the mid-month convention. In the year of disposal, depreciation is calculated through the mid-point of the month of disposal of the real property.

Code section 179 provides for an immediate expense deduction up to $25,000 for certain tangible personal property. The deduction is reduced dollar-for-dollar by the amount of section 179 property placed into service in excess of $200,000. In addition, the expense deduction cannot exceed taxable income.

The Job Creation and Worker Assistance Act of 2001 provides for a 30 percent bonus depreciation deduction on qualifying MACRS property acquired before September 11, 2004 and placed into service by January 1, 2005. The basis in each asset is reduced by the bonus depreciation in computing the annual depreciation deduction under MACRS.

## Operating vs. Capitalized Leases

When comparing companies in similar industries, the choice of leasing versus buying equipment can have a dramatic impact on the percentage of Net P, P & E / Revenues required for the business. Differences in leasing vs. buying between comparable companies also impacts EBITDA margins, requiring greater scrutiny when using multiples based on EBITDA.

In addition, tax and GAAP have different rules about classifying leases as operating or capitalized. Understanding these differences can be especially important if a 'tax to GAAP' analysis is needed.

### GAAP

All leases are considered operating leases unless they meet one of the capitalized lease criteria, as follows:

1) The lease transfers title to the property at the end of the lease term;
2) The lease contains a bargain purchase option;
3) The lease term is greater than or equal to 75 percent of the property's estimated useful life; or
4) The present value of the minimum lease payments is greater than or equal to 90 percent of the fair market value of the property.

Accounting for a capital lease requires recognizing an asset for leased property at the lesser of the present value of the minimum lease payments or its fair value. Property acquired under a capital lease is depreciated over its estimated useful life if the lease meets criteria (1) or (2), or over the term of the lease if the lease meets criteria (3) or (4).

Accounting for an operating lease calls for the recognition of lease expense on a straight-line basis. Thus, if an operating lease calls for escalating rent payments, a company will recognize the difference between the rent payments and the straight-line rent expense as a liability.

### Tax

For tax purposes, companies are required to analyze a lease to determine whether a sale has occurred to determine whether the lease should be treated as a capital lease. The main concepts in determining whether a transaction is considered a sale depends on the transfer of title in the property or the existence of a bargain purchase option. If the lease is considered a sale, it should be accounted for similar to capital lease treatment for GAAP purposes. Otherwise, companies may only deduct lease payments made for tax purposes. Deferred rent resulting from escalating rent payments for GAAP purposes is not deductible until paid.

## Conclusion

The investment in capital expenditures required in excess of depreciation is sometimes an afterthought when calculating value using the capitalized cash flow and discounted cash flow methodologies. The calculation of this investment is an important determinant of free cash flow, and can have a dramatic impact on value, especially in companies with expected high terminal growth rates and/or a high percentage of Net P, P & E / Total Assets. The model presented in this article can be used as a sanity test when estimating the percentage of depreciation to capital expenditures in perpetuity, replacing the typical assumption of capital expenditures equal to depreciation in perpetuity, which can severely overestimate value. In addition, I have provided evidence that an estimate of future capital expenditures in perpetuity using a constant percentage of capital expenditures to revenues can be a simple, accurate measure over time.

## Endnote

1. U.S. Census Bureau, "*Annual Survey of Manufacturers*", December 20, 2002.

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