Clearing Up Confusion Over Calculation of Free Cash Flow

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ABSTRACT

This paper addresses student confusion over the calculation of the key valuation measure of free cash flow. Confusion is shown to arise from the measure used to represent capital expenditures and from the treatment of depreciation expense. Even for students who have had a full complement of undergraduate finance courses, the former is clearly a point of confusion for many students and its handling has important implications for the latter. This paper illustrates the lack of clarity and consistency in standard textbook treatment of this issue, provides evidence of resulting student confusion and offers clear and easy-to-understand guidelines for students to follow to help avoid that confusion. By adhering to the guidelines presented, even beginning students should be better able to navigate through what can appear to be mystifying presentations of how to incorporate capital spending and depreciation into the computation of a firm’s free cash flow.

INTRODUCTION

The motivation for this paper was born out of the teaching of the Finance Capstone course to senior Finance majors at Temple University. The paper focuses on the confusing treatment of the key components of capital expenditures and depreciation within the context of deriving free cash flow (FCF). A review of representative corporate finance textbooks reveals a glaring lack of clarity and consistency in the presentation of the use of gross or net fixed assets to derive “capital expenditures” and in the separate explicit inclusion of depreciation. The question of whether capital expenditures is represented by a change in gross or net fixed assets is clearly a point of confusion for many students, even those who have had the full complement of undergraduate finance courses. This paper illustrates the lack of clarity and consistency in standard textbook treatment of this issue, provides evidence of resulting student confusion and offers clear and easy-to-understand guidelines for students to follow to help avoid that confusion.

Free Cash Flow: A Key Measure in Valuation

It is certainly true that in Finance “cash is king” and one principal method of valuing a business entity is through the use of FCF. FCF--also known as Cash Flow from Assets-- represents the cash that is “free” to be distributed to investors after necessary reinvestment in the firm. A standard calculation of FCF is given in expression (1).

\[ FCF = EBIT(1-T) - \Delta NWC - \text{Capex} \]

Where

FCF = free cash flow
EBIT = earnings before interest and taxes
T = corporate tax rate
\( \Delta NWC \) = change net working capital or net operating working capital
Capex = capital expenditures
The issue that gives rise to the need for some clarification involves the last term in (1) -- Capex or capital expenditures and whether extracting Capex from a firm’s balance sheet involves the change in gross property plant and equipment (ΔGPPE) or in net property plant and equipment (ΔNPPE). Although Capex and FCF can be derived without direct reference to a firm’s balance sheet through use of its statement of cash flows, students are less likely to be familiar with the statement of cash flows than they are with the balance sheet. As we will see, a related issue adding to students’ confusion is the explicit inclusion or exclusion of depreciation in the calculation of FCF.

**Student Confusion**

An indication of student confusion involving Capex and changes in GPPE or NPPE is the reaction to a question posed to senior Finance majors at Temple University. Temple’s Senior Seminar in Financial Management has as its focus the application of tools acquired in courses in the major to the valuation of a public corporation. As part of this valuation, students estimate a firm’s FCF, part of which involves the subtraction of Capex. In the process of attempting to extract Capex from items on the balance sheet, students were asked whether it was their understanding that Capex refers to (a) a change in GPPE; (b) a change in NPPE; or (c) if they were unsure. Students were surveyed in this manner over three semesters beginning in fall 2009 and covering seven separate sections of the course. Results of the surveys are presented in Table 1. Ranges of student responses were (a) zero to 45 percent for ΔGPPE; (b) 12 to 82 percent for ΔNPPE; and (c) 18 to 74 percent for “Not Sure”. From at least this limited sample, there is a great deal of confusion regarding Capex and its representation by changes in the balance sheet items of GPPE and NPPE.

<table>
<thead>
<tr>
<th>Section</th>
<th>ΔGPPE</th>
<th>ΔNPPE</th>
<th>“Not Sure”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32%</td>
<td>41%</td>
<td>27%</td>
</tr>
<tr>
<td>2</td>
<td>45%</td>
<td>27%</td>
<td>28%</td>
</tr>
<tr>
<td>3</td>
<td>0%</td>
<td>74%</td>
<td>26%</td>
</tr>
<tr>
<td>4</td>
<td>0%</td>
<td>26%</td>
<td>74%</td>
</tr>
<tr>
<td>5</td>
<td>15%</td>
<td>54%</td>
<td>31%</td>
</tr>
<tr>
<td>6</td>
<td>17%</td>
<td>12%</td>
<td>71%</td>
</tr>
<tr>
<td>7</td>
<td>0%</td>
<td>82%</td>
<td>18%</td>
</tr>
</tbody>
</table>

In light of this confusion a review was undertaken to see just how this issue is handled in representative corporate finance textbooks. Results of that review show why students might be confused.

**Capital Expenditures and Calculation of Free Cash Flow: Standard Textbook Treatment**

The lack of clarity in the presentation of capital expenditures arises from two characteristics in standard corporate finance textbooks. One is the widespread failure to clearly define “capital expenditures ” or “capital spending” while the other is inconsistent treatment in the explanations that are offered. With regard to the former, authors appear to feel no need to define capital spending in relation to balance sheet items of either GPPE or NPPE, and for the latter, explanations vary widely and can actually add to students’ confusion. In Ross, Westerfield, and Jordan (2010), for example, we find capital spending to be defined as the change in net fixed assets + depreciation, but in Graham, Smart and Megginson (2010) we’re told in footnote 6 on page 35 that Capex - Depreciation (DEP) = ΔFA where ΔFA is defined as the change in gross fixed assets thereby defining Capex as the change in gross fixed
assets plus DEP. Little wonder that students are confused. The following is a sampling of corporate finance textbooks and their treatment of Capex and FCF.

Berk, DeMarzo and Harford (2009) define Capex as “Purchases of new property plant and equipment…”(p.44) and “…investments in plant, property and equipment…”(p.246). In their calculation of FCF, the item in question is simply labeled as “Capital Expenditures” but with no guidance as to whether this represents ∆GPPE or ∆NPPE (p.573).

Brealy, Myers and Marcus (2009) do not explicitly define Capex but there is reference to a cash budget that contains “capital expenses” described as an “…outlay of cash to pay for a long-lived asset.”(p.534). In their calculation of FCF, the item to be subtracted is labeled as “capital expenditures” and is obtained from the statement of cash flows and described as the sum of ∆GPPE, ∆Intangible Fixed Assets and ∆Other Assets (pp.66-67). In the related spreadsheet presented, FCF is equal to Operating Cash Flow (OCF) minus “investment in plant and working capital” (p.382). DEP is excluded from EBIT(1-T) but included in OCF so in cases where the FCF calculation begins with OCF, no separate addition of DEP is required and this is yet another potentially confusing issue in the calculation of FCF.

According to Ross, Westerfield and Jordan (2010), “Capital spending refers to net spending on fixed assets (purchases of fixed assets less sales of fixed assets)” (p.31). While the term “net” in this context merely refers to the subtraction of the sales of fixed assets, its use here can add confusion to the issue as it can be interpreted to mean that we look to changes in NPPE for our calculation of Capex. This implication is reinforced later in the text where “Capital spending” in Table 10.5 refers to “net fixed assets” in Table 10.2 (pp.303-304).

Cornett, Adair and Nofsinger (2009) do not use a term such as “capital spending” but instead describe “investment in operating capital” (IOC) which includes, “the firm’s net investments (or changes) in fixed assets, current assets and spontaneous current liabilities (such as accounts payable and accrued wages)” (p.43). FCF is then defined as being equal to OCF minus IOC. As with other authors, use of the term “net” here can easily be interpreted to mean ∆NPPE. Any doubt as to whether this might be confusing for students is quickly dispelled as a glance at their accompanying Example 2.5 reveals that investment in operating capital equals the change in Gross PPE plus the change in net operating working capital.

**Depreciation: Add it Separately or Not?**

In any measure that is to represent a firm’s cash flow, the issue of non-cash items must be addressed and one of the most significant non-cash expense items is depreciation. While it is reasonably clear to students that a “correction” (to either EBIT or Net Income) for the subtraction of depreciation needs to be made in deriving a measure such as FCF, the treatment in standard textbooks is enough to leave students dazed. In particular, the issue is whether depreciation should be added back or not. In expression (1) above the first term on the right-hand side is EBIT(1-T) which is referred to as “NOPAT” in Finance texts and stands for “Net Operating Profit After Tax”. Depreciation is already subtracted to obtain EBIT and must somehow be added back to arrive at FCF. It can also be seen in expression (1) that there is no explicit addition of depreciation and this can also be a source of confusion.

**A Prime Example of a Confusing Presentation**

The confusing manner in which capital spending and depreciation expense are presented in the calculation of FCF is perhaps no better illustrated than in Daves, Ehrhardt, and Shrieves (2004). This is a
text that has been used in Temple’s Senior Seminar in Financial Management and has as its focus the valuation of a firm using the FCF approach. The authors build to the valuation of a real corporation through a series of increasingly detailed financial statements that begin with fictitious companies and end with the valuation of Home Depot, Inc. One of the earlier fictitious firms is Acme General and the FCF calculation (rounded to whole dollars) for Acme General is given in Table 2 (p.44).

### Table 2:
Acme General’s Free Cash Flow ($Millions)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Profit</td>
<td>$538</td>
<td>$587</td>
</tr>
<tr>
<td>Tax</td>
<td>215</td>
<td>235</td>
</tr>
<tr>
<td>NOPAT</td>
<td>323</td>
<td>352</td>
</tr>
<tr>
<td>Operating Current Assets</td>
<td>1656</td>
<td>1805</td>
</tr>
<tr>
<td>Operating Current Liabilities</td>
<td>621</td>
<td>677</td>
</tr>
<tr>
<td>NOWC</td>
<td>1035</td>
<td>1128</td>
</tr>
<tr>
<td>Net PPE</td>
<td>2070</td>
<td>2256</td>
</tr>
<tr>
<td>Total Operating Capital</td>
<td>3105</td>
<td>3384</td>
</tr>
<tr>
<td>Investment in Total Net Operating Capital</td>
<td>279</td>
<td></td>
</tr>
<tr>
<td>FCF</td>
<td>$73</td>
<td></td>
</tr>
</tbody>
</table>

FCF in Table 2 is computed as NOPAT – Investment in Total Net Operating Capital, the latter being equal to ∆Total Operating Capital or the sum of ∆NOWC and ∆NPPE. In subsequent presentations of the calculation of FCF we find the following from the authors:

\[
FCF = NOPAT - \text{Net Investment in Total Operating Capital} \quad (p.44)
\]

\[
FCF = NOPAT + \text{Depreciation} - \Delta NOWC - \Delta \text{Long-Term Investments} \quad (p.49)
\]

There are two things to note from Table 2 and expressions (2) and (3). According to Table 2, the change in long-term investments is equal to the change in Net PPE. It can be shown, however, that subtracting ∆NPPE is equivalent to subtracting ∆GPPE and adding the latest year’s depreciation. Noting that the change in Accumulated Depreciation (∆AD) is equal to the latest year’s depreciation expense, then ∆NPPE = ∆GPPE - ∆AD; and -∆NPPE = -∆GPPE + Depreciation. Therefore, use ∆NPPE to represent the subtraction of Capex (“∆Long-Term Investments”) in expression (3), as is clearly implied from Table 2, will result in the double counting of depreciation! What’s going on here--are the authors double counting the correction for depreciation? As it turns out, depreciation is being added back only once but students would be hard-pressed to realize this from the manner in which the material is presented. The reason that depreciation is not being double-counted here is because the Capex term in (2) refers to the change in Net PPE while the Capex term in (3) refers to the change in Gross PPE. Is there any wonder that students are confused?

**Sources of Confusion and Some Clarification**

From the foregoing we can identify the main sources of confusion in the calculation of FCF. These are (a) the failure to clearly define capital expenditures in terms of gross or net PPE; (b) the use of the term “net” in conjunction with investment spending; and (c) the apparent sometime inclusion and sometime exclusion of depreciation expense.

Does Capex Reflect ∆GPPE or ∆NPPE? It can easily be demonstrated that Capex is directly represented by ∆GPPE rather than ∆NPPE. If a firm neither purchases nor sells any fixed assets in a year its ∆GPPE would appropriately be zero but its ∆NPPE would be lower by the amount of any depreciation
expense in that year. Depreciation expense should not be mistaken for a reduction in fixed assets, but this is precisely what would result from using ∆NPPE without an adjustment for depreciation expense to represent Capex. By adjusting for depreciation, Capex can be defined equivalently as either (4) or (5).

Capex = ∆GPPE  
(4)  
Capex = ∆NPPE + Depreciation  
(5)  

Meaning of “Net” in Definitions of Capex. As noted earlier, Capex is commonly defined as the “net” change in long-term assets. In this context, “net” simply means “minus” as in the acquisition of new long-term assets minus or net of the liquidation of existing long-term assets. In order to avoid confusion, it is critical to emphasize that this “Net” is not the “Net” of “Net PPE”!

Add Depreciation Separately in Calculating FCF? Perhaps even more confusing than the measure of Capex is how depreciation expense should be handled in the calculation of FCF. In particular, the question is whether depreciation is to be added separately in the derivation of FCF. A review of calculations of FCF could lead to the conclusion that sometimes depreciation is added and sometimes it isn’t. In the absence of any clarifying guidance, students encountering the calculation of FCF for the first time could easily conclude that the explicit inclusion of depreciation is determined by the whim of the author. As it turns out, whether to include depreciation explicitly is inextricably linked to the definition of Capex used in the calculation.

Many students are aware of the fact that depreciation is a non-cash expense item and thereby does not represent an actual cash outlay. They may also be aware that depreciation is deducted—just as are cash expenses—to arrive at EBIT and understand that deriving a measure of cash flow requires a correction in the form of adding back depreciation. The critical issue in the calculation of FCF, however, is that this correction can be made only once. As indicated above, Capex is subtracted in the calculation of FCF and if ∆NPPE is used for Capex this is equivalent to subtracting the ∆GPPE and adding the latest year’s depreciation. Since depreciation should be added back only once, adding depreciation separately along with using ∆NPPE to represent (the subtraction of) Capex would double count the depreciation correction. Such double-counting would likewise occur if depreciation were added separately in calculations of FCF that begin with OCF since the latter already includes depreciation.

Key Points

The foregoing discussion generates the following key points that can help students avoid the confusion described above and successfully navigate the maze of calculating FCF:
• Capex = Either ∆GPPE or (∆NPPE + Depreciation)  
• Using ∆GPPE for Capex neither adds nor subtracts depreciation  
• Subtracting ∆NPPE for Capex neither adds nor subtracts depreciation  
• Subtracting ∆NPPE for Capex both adds and subtracts (and cancels out) depreciation  
• The measure chosen for Capex carries an important implication for the treatment of depreciation

Guidelines for Calculating FCF

The key points cited above lead to some clear guidelines for the usage of the measure of Capex and the inclusion of depreciation in the calculation of FCF, keeping in mind that the correction for depreciation is to be made only once.
Table 3:

<table>
<thead>
<tr>
<th>Capex Measure Subtracted</th>
<th>Adds or Subtracts Depreciation?</th>
<th>Must Add Depreciation Separately?</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔGPPE</td>
<td>Neither</td>
<td>Yes</td>
</tr>
<tr>
<td>ΔNPPE</td>
<td>Adds</td>
<td>No</td>
</tr>
<tr>
<td>(ΔNPPE + Depreciation)</td>
<td>Both (Cancels Out)</td>
<td>Yes</td>
</tr>
</tbody>
</table>

By following the guidelines in Table 3, students will be better able to maintain a clear picture of appropriate measures of Capex and the associated combination of the measure of Capex and the treatment of depreciation in the calculation of FCF.

REFERENCES


