

Our first discussion of Maintenance Capital Expenditures (“MCX”) occurred here:
<http://wp.me/p1PgpH-6t>

One method of learning is to EXHAUSTIVELY analyze and read about a subject so we can master the topic and understand the principles and subtleties in applying those principles. Please read the case study on IRDM to learn more about analyzing EBITDA-MCX

We are focused on **Return on Invested Capital** which has been defined one way as Operating Earnings (Earnings before Interest Expense and Taxes, **EBIT**) or better yet, (Earnings before Interest Expense, Taxes and Depreciation & Amortization, “**EBITDA**” – MCX) divided by tangible capital or (Net Working Capital + Net Property, Plant and Equipment). We have covered EBITDA thoroughly in a 36 page discussion here:
<http://www.scribd.com/doc/66843869/Placing-EBITDA-Into-Perspective>.

Now we review MCX as part of the (EBITDA – MCX) calculation.

Your goal in valuing a company is simply to discount back to the present value all future cash flows of the business. Easier said than done! But to understand a business you must first know what are owner’s earnings, what cash is available to you after all the necessary expenses/costs have been made to run the business properly. Professor Greenblatt uses a *pre-tax* method for easier company comparisons (EBITDA –MCX) while Buffett uses an *after-tax* method (discussed later).

Your specific company and industry knowledge should help you calculate **true** or normalized maintenance capital expenditures. For example, say you are the operator of an amusement park—one of two—in Phoenix, AZ and you need to plan your future budget. Every year you need to replace certain equipment, repaint the Merry-Go-Round, etc. But what if your competitor is planning a new exhibit with special effects? **Do you budget increased expenditures to match your competitor and remain competitive so as not to lose customers?** Will you be able to maintain your competitive position? As an analyst you may need to significantly raise your estimate of **true, future MCX** so as to not underestimate normalized earnings. Imagine if you were a luxury hotel owner and your competitor put in new wide-screen high-definition TV screens in all the hotel’s rooms, would you match that expense/investment or lose customers?

Prof. Greenblatt Discusses MXC

Prof. Greenblatt would implore his students on EBITDA—don’t show this in your reports. You have to subtract out the maintenance capital expenditures (MCX). Now, if the company is growing and you want to figure out “normalized earnings.” Capital spending is the number to use. Capex is a cash expense but depreciation is a book entry not cash expense.

Let us say you are opening 10 new stores in addition the 10 stores you already have, the capex would include keeping up (maintaining their competitive position) the ten stores you already have making capex on those stores and the cost of opening the ten (10) new stores. But you won’t get the benefit of those new stores in that year. **What you really want for normalized**

earnings is maintenance capex. How is this number reported? Ask the management. Break-out growth vs. MCX.

Prof. Greenblatt ask for an explanation for MCX and how do they get there. Usually the company understates mcx. When $EBITDA - DA = capex$, then $EBIT = EBITDA - Capex$. A quick and dirty when you use EBIT. I try to get at $EBITDA - maintenance$. capex.

Student: Does $Ebit = Ebitda - Maintenance Capital Expenditures (MCX)$ used in the book?

Prof. Greenblatt: Right, I put a little note in there for the *MBA Students* in the book. I assumed $MCX = D\&A$ for simplicity purposes. Figuring out MCX for a lot of these companies is pretty hard. On average it (*using EBIT*) is pretty close to being right for simplistic purposes. If I were doing it myself, I would check to see the true MCX and subtract that number from EBITDA. You might use EBIT as a check to see if you are close.

Good companies have high returns on capital (ROIC)

- Defined as operating profit ($EBIT$ or $EBITDA - MCX$ (Maintenance Capital Expenditures)) divided by working capital plus net fixed assets
- Why do you view EBIT rather than FCF? EV to EBIT. $EBITDA - MCX$ or a pre-tax cash flow?
- EV to EBIT is a euphemism. Changes in working capital need to be taken into account (if you use Cash Flow from Operations. You have to adjust those metrics to see if they are representative to the company. If there is a difference between earnings and cash, I will use cash.

A good author to follow is John Emerson Articles (71)

<http://www.gurufocus.com/news/137623/understanding-free-cash-flow-series-growth-vs-maintenance-capex>

Understanding Free Cash Flow Series: Growth vs. Maintenance Capex

What is the proper method of separating growth and maintenance capital expenditures (capex).

Why Is It Important to Separate Growth and Maintenance Capex?

The answer is simple; in most cases *growth capex is an investment*, while *maintenance capex is a cost*. If a business decided to suspend its growth operations, its capex would quickly decline and the result would be increased free cash. The key is to make sure that the reinvested capital is earning a sufficient rate of return to justify the growth expenditures.

Allow me to revisit the hypothetical one-man trucking company which I invented in my last article. <http://www.gurufocus.com/news/137384/understanding-free-cash-flow-series-depreciation-and-accounts-receivable> Suppose that instead of selling the business the owner decides he wants to expand by adding additional rigs and hiring drivers.

Common sense dictates that buying a new rig is a *different type of capital expenditure* than installing a replacement set of tires on tractor-trailer. The new rig represents an investment in **growth capex**, while replacing the tires is a classic example of **maintenance capex**.

Growth capex can be defined as any expenditure which is undertaken in the interest of increasing revenues and profits, while maintenance capex can be defined as any expenditure which is undertaken **to sustain current revenues and profits**. The lines can become blurred between the two distinctions.

Suppose I decide to continue my one-rig operation and after 10 years my rig is no longer suitable for hauling freight. Under those conditions the purchase of the new rig would be considered as maintenance capex spending since it would merely maintain rather than increase my existing profits.

How Is Growth and Maintenance Capex Separated?

Most companies do not breakout growth vs. maintenance capital expenditures in their annual or quarterly reports. That reality forces investors to do some guess work when attempting to separate the two entities.

Two common methods are used to separate capital expenditures; the most simplistic method is to merely deduct depreciation from total capital expenditures. *Depreciation is assumed to be maintenance capex*, the remaining balance is assumed to be growth capex (Growth Capex = Total Capex less Depreciation).

The effectiveness of that formula is dependent upon the company's ability to correctly state its depreciation. If the company is understating depreciation in an attempt to manage earnings upward or if they are overly optimistic about the longevity of their fixed assets, growth capex will be materially overstated.

Back to the one-rig trucker for a moment; one of his biggest maintenance expenditures is buying new tires. Let's say that in the past the owner has depreciated them over a three-year period but since he changed his route to a hotter region, they are only lasting an average of two years.

Although he did it inadvertently, he had materially understated his depreciation expense, thus his prior accrual earnings have been inflated. If we had used his old depreciation estimate to approximate maintenance capex, we would have underestimated the "true cost" of maintaining his stream of free cash flow.

An alternative method for calculating maintenance capex has been suggested by Bruce Greenwald and summarized by **Jae Jun** as follows:

- Calculate the Average Gross Property Plant and Equipment (PPE)/ sales ratio over 7 years
- Calculate current year's increase in sales
- Multiply PPE/Sales ratio by increase in sales to arrive to growth capex
- Maintenance capital expenditure is the capex figure from the cash flow statement less growth capex calculated above.

I believe that for most companies the Greenwald system for calculating maintenance capex is superior than merely substituting depreciation for maintenance capex, however as you will see in the in my upcoming discussion of Casey's it is far from perfect. **The more intimately an investor understands a business, the easier it is to estimate its maintenance capex requirements.**

Estimating Maintenance Capex for CASY

Casey's owns and operates a string of convenience stores throughout the Midwest which provide gas and sell cigarettes and a limited supply of groceries; they are also one of the country's largest pizza outlets. They also fry their own donuts and sell them at their outlets.

The company generates the majority of its revenues (61%) from gasoline sales however the gross margin of those sales is only about 5%. The groceries generate gross margins of around 30%; the real money-maker is prepared foods items which generate gross margin in excess of 60%. The latter two categories generate 74% of the profits.

The business model for CASY involves setting up stores in smaller rural communities where less competition exists; over 60% of their stores reside in communities with populations of 5000 or less. More recently they have been purchasing stores in larger communities and rebranding them under the Casey's logo.

The strategy involves constructing new stores as well as buying competing stores at reasonable prices, rebranding them and building a kitchen which allows them to prepare pizza, donuts and other food items. The construction of new stores and the rebranding and remodeling to facilitate their restaurant sales in recently purchased stores, is a perfect example of growth capex. Clearly that type of activity needs to be separated from capex which is necessary to maintain existing stores if one hopes to ascertain the true profitability of the enterprise.

If CASY was to stop constructing new stores as well as buying and remodeling new stores, the result would be a quick reduction of capital expenditures (as soon as the remodeling was completed); the effect would be an immediate increase in free cash. In essence, the company would be sacrificing future growth in favor of increasing its near term production of free cash. This is a decision that almost every business faces at some point in time after it matures

Maintenance Capital Expenditures

sufficiently and runs out of opportunities to expand without changing its business model in some material form.

In regard to CASY, I believe that Greenwald's model of estimating maintenance capex is inappropriate since gas sales represent over 60% of revenues. For most businesses, the ratio between plant, property, and equipment (PP&E) and revenues represents a pretty stable figure. No such stability exists at CASY due to the volatility of gas prices. Higher gas prices result in increased revenues but not necessarily in higher profits.

Greenwald's formula would have to be reformed to factor out fluctuating gas prices; figuring revenues for groceries and prepared foods as a percentage of PP&E might work, but for practical purposes, equating maintenance capex with depreciation is the best solution for this company.

CASY breaks down its capital expenditures by separately listing its purchases of property and equipment, from its payments for acquisitions of businesses, before adding back its property and equipment sales.

Cash flows from investing activities				
Purchase of property and equipment	(129,233)	(136,351)	(82,498))
Payments for acquisition of businesses	(45,688)	(11,813)	(8,858))
Proceeds from sales of property and equipment	1,769	3,200	3,223	
Net cash used in investing activities	(173,152)	(144,964)	(88,133))

That provides little information as to the cost of remodeling a store although past CASY annuals have disclosed the average construction cost for building a new store. Theoretically, one could multiply the new store constructions by the average cost and whittle away at the figure but in the end **it is unlikely that a figure more accurate than the companies stated depreciation could be attained.**

Continued.....

Maintenance Capital Expenditures

So what is CASY's adjusted FCF average for the past three years when growth capex is factored out?

Net cash provided by operating activities	\$214,068	\$170,624	\$177,422
Depreciation and amortization	\$73,546	\$69,451	\$67,893

The company has averaged just under 117 million per year in FCF in the past three years. That puts the multiple at around 14.3X its market cap or about 19.6x its enterprise value. That sounds expensive but one does need to consider the fact that the company owns virtually all the land on which its stores reside, and many of its stores are located in areas which provide the company with a significant moat.

Conclusion

- 1) **It is impossible to estimate the intrinsic value of a business in terms of free cash flow if one does not separate growth vs maintenance capital expenditures.**
- 2) If growth capital expenditures were discontinued, the free cash would almost certainly increase for most businesses.
- 3) Growth Capex should be viewed as an investment; maintenance capex should be viewed as an expense.
- 4) Two methods are commonly used to estimate maintenance capex: the simple method assumes maintenance capex = listed depreciation, the second uses a formula which involves using PP&E as a percentage of revenues.
- 5) Calculating maintenance capex is an estimation, having an intimate understanding of a companies' business model is important in deciding which method to use.

I hold no position in CASY

About the author: *I have been of student of value investing since the mid-1990s. I have continued to read and study value theory on an ongoing basis. My investment philosophy most closely resembles Walter Schloss although I employ considerably less diversification. I also pattern my style after Buffett's early investment career when he was able to purchase shares of tiny companies.*

Whitney Tilson (www.tilsonfunds.com) Discusses Capex

Let's start with a quick example: a company buys a truck for \$100,000 that it expects will last for 10 years. The company will depreciate \$10,000 each year over that period -- an expense on the income statement (albeit one that is not usually broken out separately). In the first year, on the cash flow statement \$10,000 will be added back in the "Depreciation and amortization" line, and the full \$100,000 cash cost will appear under cap ex.

On the balance sheet, as soon as the truck is purchased, cash will decline by \$100,000 and

"Net property, plant and equipment" will increase by the same amount, and then decline by \$10,000 per year as the depreciation is moved to the income statement.

(Incidentally, the failure to account for cap ex is one of the many reasons why EBITDA -- earnings before interest, taxes, depreciation and amortization -- is such a bogus number. EBITDA ignores very real, very necessary, and often very large capital expenditures. Occasionally there is a legitimate reason for a company to use EBITDA as its primary measure of profitability, but in general, be very wary when this is the case.)

Maintenance Cap Ex vs. Growth Cap Ex

Maintenance cap ex is what a company has to spend to maintain its existing operations and market position. In a business with low or modest growth, almost all of cap ex is typically for maintenance. In this case, depreciation will generally be roughly equal to cap ex.

Growth cap ex is what a company spends beyond what is necessary to maintain its current competitive position—the company is adding assets not replacing those assets. In this case, a company is taking its free cash flow and, rather than returning it to shareholders (via dividends or stock buybacks), is investing it in the hopes of generating a return above the cost of that capital. Companies that can't earn a return above their cost of capital on their growth capex either destroy value or do not increase intrinsic value.

But how can one distinguish between the two types of cap ex, since they are combined in the cash flow statement? Sometimes a company will give guidance, but you generally just have to use your judgment (*or you can use the Greenwald method of breaking out MCX from total capex discussed later*). If cap ex is significantly higher than depreciation, or had been steady for many years, and suddenly spiked up, it could indicate new growth cap ex. (It could also mean that the company had been spending too little on maintenance cap ex in the past.)

If it's a steady, modest-growth business, with depreciation roughly equal to cap ex, then it's probably safe to assume that all the cap ex is for maintenance. This is also generally true at the opposite end of the spectrum: it is hard to argue that a rapidly growing company with fast-changing technologies could safely cut cap ex and maintain its market position and cash flows. (Keep in mind, however, that current cash flows may not be a good way to value this type of business.) Thus, to be conservative, I generally deduct all cap ex to arrive at free cash flow unless I have a concrete reason to do otherwise.

In Lucent's case, cap ex is somewhat higher than depreciation and amortization, which shows that Lucent is investing increasing amounts in its business (assuming that the line item for depreciation and amortization is mostly depreciation). By itself, this is neither good nor bad -- it depends on how wisely the money is being invested. I'm sure some would argue that a great deal of Lucent's cap ex is for growth, but I don't think Lucent has much choice given that it is in ferociously competitive, fast-moving industries. Thus, I believe it is correct to subtract all cap ex to arrive at free cash flow, but if you want to instead use the lower figures from the depreciation and amortization line, I won't quibble. It doesn't change the results very much.

Deducting Depreciation and Amortization Rather Than Cap Ex

There are two reasons why I sometimes deduct depreciation and amortization (D&A) rather than cap ex in my calculation of free cash flow. First, if I know a company is investing heavily in growth, then the lower figure for D&A is likely to be closer to the cost of maintenance cap ex. Second, sometimes cap ex can vary widely from quarter to quarter, which can give the false impression that free cash flow is erratic. For example, I recently analyzed Blyth (BTH) and over the past 10 quarters, cap ex has ranged from \$4.9 million to \$24.4 million. However, D&A has risen fairly steadily from \$4.6 million to \$8.7 million. Thus, when calculating Blyth's free cash flow, I deduct D&A rather than cap ex from operating cash flow.

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<http://www.oldschoolvalue.com/blog/valuation-methods/calculating-maintenance-capital-expenditure/>

Bruce Greenwald's Method to Calculate Maintenance Capex

In a previous post on **how to calculate maintenance capital expenditures**, I outlined the general aka quick and dirty method of calculating maintenance capex which is

$$\text{Maintenance Capital Expenditure} = \text{Depreciation and Amortization}$$

Although if you smooth out all the depreciation values across several years, you'll be okay with your numbers, but what if you want to go one step further?

Since depreciation can be misleading, you may be missing out on opportunities by unknowingly using a unrealistically high number for maintenance capex calculations. This is where Bruce Greenwald's method of **calculating maintenance capex** makes a lot of sense.

Calculate the ratio of PPE to sales for each of the five prior years and find the average. We use this to indicate the dollars of PPE it takes to support each dollar of sales. We then multiply this ratio by the growth (or decrease) in sales dollars the company has achieved in the current year. The result of that calculation is growth capex. We then subtract it from total capex to arrive at maintenance capex. – pg96 of [Bruce Greenwald's EPV book](#).

The above text in an understandable manner is as follows: ([from my Value Idea](#))

- Calculate the Average Gross Property Plant and Equipment (PPE)/ sales ratio over 7 years
- Calculate current year's increase in sales
- Multiply PPE/Sales ratio by increase in sales to arrive to growth capex
- Maintenance capital expenditure is the capex figure from the cash flow statement less growth capex calculated above, which is the true depreciation for the company

I also have been able to implement this into the [stock investment spreadsheet](#) to perform the calculations automatically with just a single ticker input. I'll be using screenshots of the

investment spreadsheet to take you through the examples. (The stock value calculation spreadsheet that supports EPV and the images below will be released in October)

Maintenance Capital Expenditure Calculations

Wal-Mart is an easy example to start off with because of its consistency.

	2005	2006	2007	2008	2009
PPE as a % of Sales	21.2%	22.8%	24.0%	25.4%	25.4%
Sales Growth (decrease) to Prior Year	\$ 28,893.0	\$ 27,205.0	\$ 36,223.0	\$ 30,149.0	\$ 26,808.0
Capex	\$ 12,893.0	\$ 14,563.0	\$ 15,666.0	\$ 14,937.0	\$ 11,499.0
Maintenance Capex	\$ 6,760.0	\$ 8,351.0	\$ 6,958.0	\$ 7,285.6	\$ 4,698.8
Depr & Amort	\$ 4,405.0	\$ 4,717.0	\$ 5,459.0	\$ 6,317.0	\$ 6,739.0

- From 2005 to 2009, WMT PPE as a percentage of sales ranged from 21.2% to 25.4%.
- The 2nd line shows the sales increase. It is simply calculated by this year's sales minus last year sales.
- Capex line is the actual stated amount of capital expenditures in the financial statements.
- To calculate the maintenance capital expenditures for 2009 you do $25.4\% \times \$26,808 = \$6,809$
 - The \$6,809 value is the growth capex so then subtract the result from Capex to get $\$11,499 - \$6,809 = \mathbf{\$4,690 \text{ maintenance capex}}$
 - \$4690 is the maintenance capital expenditure amount WMT used in 2009.

Compare the value of \$4,690 to the stated depreciation and amortization amount of \$6,739. Look at the difference in values between 2005-2009. Since depreciation and amortization is a straight line approach in accounting, the amount is increasing while maintenance capital fluctuates depending on the business cycle.

So it seems like that the method Bruce Greenwald teaches is a much more accurate representation of maintenance capex.

Now a review of Warren Buffett on Owner Earnings

Warren Buffett has referred to the 'owner earnings' of a company as the true measure of earnings. He has defined 'owner earnings' as: ■

Reported earnings + depreciation, amortization, other non-cash items - average annual amount of capitalized spending on plant, machinery, equipment (and presumably research and development).

Reasoning behind owner earnings

Depreciation: You should not consider depreciation because this is generally a fixed percentage of an amount spent in the past that does not necessarily reflect the true cost of replacing things when they are obsolete.

Amortization: Buffett has often criticized accounting amortization of things such as economic goodwill. Economic goodwill, including things such as brand name, reputation, monopolistic or market dominance, might actually increase in value rather than depreciate.

Capital expenditure: It is difficult to estimate true capital spending. Items may be deferred or brought forward. *Averaging* actual expenditure is a more reliable guide of a company's true capital needs.

For a detailed discussion of Buffett's methods: <http://www.fwallstreet.com/article/26-calculating-the-value-of-a-business-part-ii/>. By the way, a great learning web-site: <http://www.fwallstreet.com/>

Calculating The Value Of A Business – Part II July 20, 2007 by Joe Ponzio

In Part I, we looked at Shareholder Equity as the first step in calculating the value of a company. Shareholder Equity essentially tells us how much our company is worth if it shut down operations, sold off its assets, paid its debts, and distributed the cash to the shareholders. Though Shareholder Equity tells us the “wind up” value of the company, we do not expect our company to, well, wind up its operations.

Thus, we need to know its *intrinsic* value-our company's value as an ongoing business. Once again, as always, we turn to Warren Buffett for advice.

Intrinsic Value Revisited

A quick refresher on the definition of intrinsic value by Warren Buffett, with highlighting added by me:

Intrinsic value is an all-important concept that offers **the only logical approach to evaluating the relative attractiveness of investments and businesses**. Intrinsic value can be defined simply: It is the discounted value of the cash that can be taken out of a business during its remaining life.

Intrinsic value is the “wind up” value-cash we get when the company shuts down-plus any future cash that our business can generate, which can then be distributed to us or plowed back into the company to generate even more cash.

Owner Earnings

In his 1986 Letter to Shareholders, Warren Buffett defined the term “owner earnings”-the cash that is generated by the business' operations, regardless of the earnings the company reports to Wall Street. Mr. Buffett:

...we consider the owner earnings figure, not the GAAP [earnings] figure, to be the relevant item for valuation purposes-**both for investors in buying stocks** and for managers in buying entire businesses.

The owner earnings calculation tells us whether or not our business could survive, and thrive, on its operations alone, or if it constantly needs to find alternative sources of cash (selling stock, taking on debt, etc.) to grow. In addition, owner earnings are essentially our earnings-the amount of cash our business can use to pay us or fuel growth.

Understanding Owner Earnings

Mr. Buffett, how do we determine owner earnings?

[Owner earnings] represent (a) reported earnings plus (b) depreciation, depletion, amortization, and certain other non-cash charges...less (c) the average annual amount of capitalized expenditures for plant and equipment, etc. that the business requires to fully maintain its long-term competitive position and its unit volume.

(Don't worry-it is easier than it sounds. In 1986, it was fairly difficult to obtain information. Today, it is all right at our fingertips with a click of the mouse.)

Reported Earnings (the earnings Wall Street adores) *plus* **Non-Cash Charges** (tax write-offs that did not actually require cash) *minus* **Capital Expenditures** (the cash the business must spend to keep product pumping off the assembly line, so to speak).

Think in terms of your personal finances: You (a) report certain income to the IRS for taxes, you (b) get certain allowed write-offs, even if they didn't cost you a dime in cash, and you (c) have to repair or replace your car every few years to get to and from work-"expenditures" that don't show up anywhere on your tax return but still eat up your cash. Your "reported" income on your tax return says one thing; your "owner earnings" probably tell a much different story.

Finding The Information

Before you throw your hands in the air, decide it is too difficult and "math-y", and skip to a site offering the next "hot stock tip," I'll let you in on a secret-somebody has already done the work for us. Still, follow me through an example so you can understand where the numbers come from and how to do it yourself. Then, I'll tell you where to find what you need.

We start with the Statement Of Cash Flows-an accounting report that companies must submit to the SEC along with their annual reports. Broken down into three sections, the Statement Of Cash Flows tells us (1) how much cash the business generates (or eats) From Operations, (2) how much it generates (or eats) From Investing Activities, and (3) how much it generates (or eats) From (external) Financing.

As is, Buffett called these reports "absurd" because the Cash Flow From Operations does not include the capital expenditures the company has to spend on property, plants, machinery, and

equipment (item c in Buffett's calculation). Capital expenditures are listed under the heading "Cash Flows From Investing Activities" for some reason. To quote Buffett:

Why, then, are "cash flow" numbers so popular today? In answer, we confess our cynicism: we believe these numbers are frequently used by marketers of businesses and securities in attempts to justify the unjustifiable (and thereby to sell what should be the unsalable)...though dentists correctly claim that if you ignore your teeth they'll go away, the same is not true for [capital expenditures].

To calculate owner earnings, you must rearrange the "absurd" to make it "rational." Let's look at the famous Johnson & Johnson valuation valuation that so many thousands have enjoyed.

Calculating JNJ's Owner Earnings

At the end of 2006, Johnson & Johnson reported to the SEC \$14,248 million of "Net cash flows from operating activities"-the basis for our calculation. If you look under "Cash flows from investing activities," you'll see that JNJ also spent \$2,666 million on "Additions to property, plant and equipment" without which JNJ could not produce its products. Ready for the hard part?

Subtract \$2,666 from \$14,248-you have \$11,582 million in owner earnings for 2006. "Wait," you say. "Buffett says we should use the average annual amount to find owner earnings!" Right-which is precisely why we don't judge a business on one year of performance and we analyze companies using many multi-year timeframes. But that's part of the discussion for Part III.

And Here's The Cheat

I keep referring to Morningstar's site as a source of research. Believe me-I am not in any way affiliated with them and I am not a big fan of mutual funds for most investors. Still, I have to keep going back to them because they've already done a lot of the heavy lifting for us.

This link will take you to Morningstar's Cash Flow report for Johnson & Johnson. Change the ticker and you'll find reports for thousands of companies. At the bottom of the report is "Free Cash Flow". Voila!

Calculating The Value Of A Business – Part I

July 19, 2007 by Joe Ponzio

The Greater Fool Theory is a belief that you can buy a stock at any price and sell it to some other, bigger fool for a profit. In times of ever-increasing markets, this theory often shows itself to be true. Still, reality must come crashing down at some point. It *always* does. And that is precisely when great fools lose tons of money, and great investors come to life.

There is definitely no shortage of fools in the market. In their ongoing quest for short-term profits, fools will, with absolute disregard for value, drive prices up and down wildly. And they will invariably screw up-**to the ultimate profit of smart business investors.**

Let's take some investing advice from Warren Buffett, and use it to determine how to value a business.

Understanding Market Mania

The key to investment success is to identify which companies will rise in price-faster and longer than the others. Over the long term, the price of an investment follows its value. To know whether or not an investment's price will rise in the coming years, you need to purchase that investment at a discount to its value and then hope that value will rise.

Buffett says,

In the short run, the market is a voting machine but in the long run it is a weighing machine.

On a day-to-day basis, the fools will fly bad companies high and drive wonderful companies down-and vice versa. Over time, however, the markets will drive the price of great companies up-and that of bad companies down.

Understanding Value Vs. Price

One of the most misused terms on Wall Street is "value". Stocks are commonly referred to as "undervalued" or "overvalued" in reference to whether or not they are attractively priced. The reality is such that a stock can never be under- or overvalued-merely under- or overpriced. The value of a company at a given point in time is fixed, the price moves rapidly above or below that value as the fools play with the stock.

As Warren Buffett tells us:

Price is what you pay, value is what you get.

In other words, no matter what price you pay for a stock, you end up with the same amount of value.

Putting Them Together

What is the world's greatest investor telling us? Simply this-if you buy \$1 worth of a growing business, and you spend less than \$1 to get it, you will make money in the long term. Is that a guarantee? No-but it is as close as you can get, and certainly more of a sure thing than Wall Street is offering.

What Is The Value Of A Business?

When determining the value of a company-and hence, the price you should pay for its stock-you need to know the company's *intrinsic value*-its value as an ongoing business. The intrinsic value is the value of a company's operations if it had to rely on operations alone to grow and pay its

bills. Though at first glance that may seem obvious, it is not always so. Too many companies rely on taking on debt, selling assets, or issuing stock to fuel their growth or sustain operations. These actions all serve to reduce the company's value.

Mr. Buffett?

The critical investment factor is determining the intrinsic value of a business and paying a fair or bargain price.

Intrinsic value is comprised of two things-the Shareholder Equity of the company today and the discounted value of the cash that can be taken out of the business. Let me put that into Plain English.

Shareholder Equity

Shareholder Equity is a company's net worth. It is essentially the sum of money investors would be entitled to if the company stopped operations, sold off all of its assets, paid off its debts, and distributed cash to owners.

When you buy a company, you are entitled to your fair share of its net worth if the company closed up shop. A quick way to understand this is to think in terms of a small business. If two business partners decided to close down and go their separate ways, they would each take half of the equipment, signs, etc.

When you buy a stock, you are becoming a partner in the business-along with thousands of other investors. Should your company close down, you would be entitled to your share of the desks, signs, etc.

Why Shareholder Equity Matters

Most investors do not concern themselves with Shareholder Equity because they do not believe that their company will ever go out of business. Maybe they're right. Still, Shareholder Equity is a base that protects you from years of slow growth, from competitors tapping into your company's markets, and from a "worst case scenario" of your company closing down or being forced to liquidate.

Shareholder Equity is easily found on any balance sheet of any company. For example, take a look at [Berkshire Hathaway's Shareholder Equity](#). In 2000, an investor in Berkshire would have been entitled to his or her share of \$61.7 billion if the company was liquidated. In 2006, that same investor would have been entitled to share in \$108.4 billion if Berkshire closed down.

Moving On

Take a look at [Part II of Calculating A Business' Value](#)-the discounted value of the cash that can be taken out of the business. Don't worry-technology has made it pretty easy to figure out.

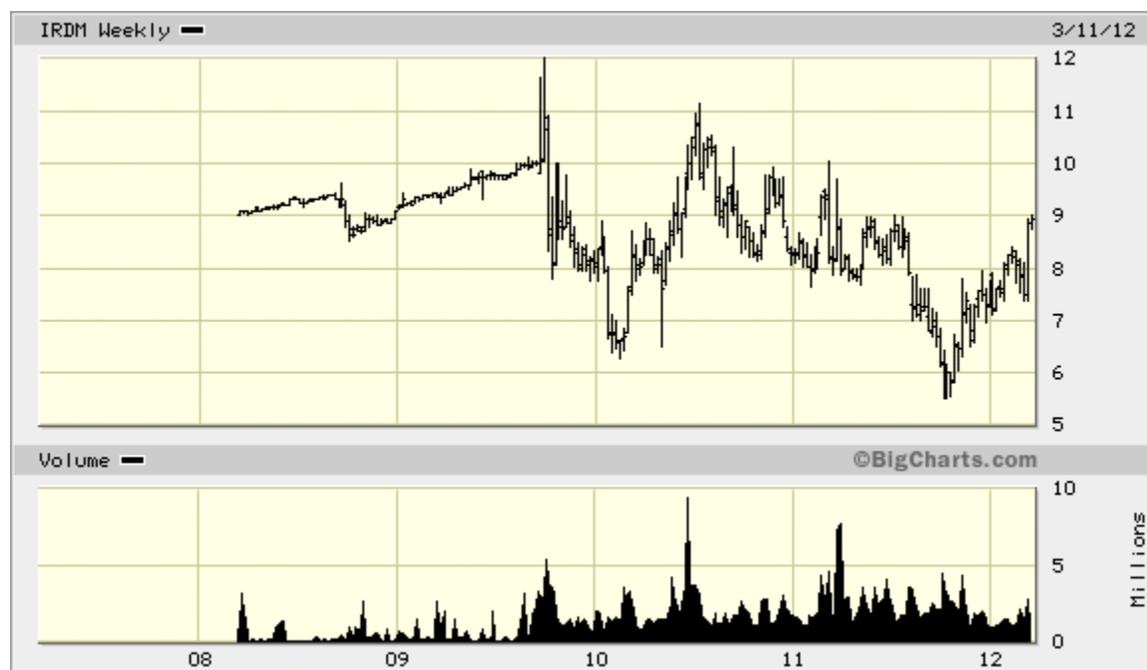
Case Study

What is considered MCX can be crucial for the valuation of a business. Take Iridium (IRDM) the satellite telecom company. I posted six reports, both long and short ideas, on IRDM. One lesson is to stay away from the too-difficult-to-call or the controversial. But the main lesson is to understand how difficult a job the analyst has in determining real owner's earnings. In this case as you will learn from the different reports, what future cash flows will be depends upon the **competitive dynamics of the industry** and what is the true MCX required to maintain the company's competitive position. Using EBITDA as a metric and P/E multiples might be dangerous because Satellites are not buildings, they must be replaced, repaired and upgraded. The cost to replace and upgrade may require billions plus be an on-going—every 15 years—expense. Note that EVERY public satellite company has gone BANKRUPT at least once. IRDM emerged from bankruptcy in 2008. *Share what you have learned in this case. Thoughts?*

Tilson Funds on IRDM: <http://www.tilsonfunds.com/IRDM> and <http://www.tilsonfunds.com/IRDM-4-11.pdf>

<http://seekingalpha.com/article/304287-iridium-could-this-satellite-service-provider-become-a-high-flyer> No discussion of capital expenditures except in the comment section

<http://seekingalpha.com/article/181643-iridium-why-i-m-buying-this-forgotten-communications-company> Poor analysis.



Listed below are several research reports on buying and shorting IRDM. How a business is viewed makes quite a difference so you need a framework to remain objective.

IRIDIUM COMMUNICATIONS INC (IRDM) - \$8.31 Posted on 02/13/11 04:08 PM by dallepalle

Overview:

I propose a **short** position in Iridium as:

a) company will have to reduce handset pricing to control churn / business generates c. \$35 - 45m of EBITDA in handset sales, which is unsustainable

b) pricing in core satellite voice business likely to come under pressure in fy'11 as handset voice will become key growth area for Inmarsat

c) Iridium is currently procuring a new constellation, which will cost c.\$3.0bn. Thus far Iridium has received a \$1.8bn credit facility. In my view, the EBITDA shrinking due to 1 & 2 will make it difficult for Iridium to generate an additional c.\$1.2bn over the next few years (c.\$200m likely to be contributed by hosted payloads)

d) If Iridium is unable to finance a new constellation, this business will go bankrupt, simply because the old constellation will stop working at some point --> this is my most likely outcome at the moment yet key risk is that French banks waive covenants...

e) Street is very far off on this name (three buy recommendations on the name) & do not factor in increased competition and not even the increased interest costs... think this is positive as stock will de-rate once street will adjust due to above

Company overview

- Iridium is a global satellite voice and data solutions provider
- The company operates 66 low earth orbit (LEO) satellites, which have been in operation since 1997 / 1998
- Key products include: satellite phones (100% global coverage), maritime voice & data, asset tracking & fleet management devices (M2M)
- Based on the latest quarter c.21% of revenue is generated by the US Department of Defense (mainly satellite phone communication requirements), c.50% is generated in commercial services (i.e. private individuals using satellite phones / asset tracking demand) & c.29% is generated in equipment sales

Thesis summary

- New competition in handset: Iridium generates c. 29% of revenues from equipment sales (i.e. selling satellite phones). Inmarsat (Iridium's major competitor) has recently entered this market selling a similar quality phone for \$500 versus Iridium at \$1,200. I estimate that Iridium generates c. \$35 - 45m of EBITDA annually in this segment, which is unsustainable given competitive pressure (i.e. Iridium will have to cut handset pricing)

- Pricing in voice likely to deteriorate: Iridium has been the only global provider of satellite mobile phone services over the last few years / this is changing as Inmarsat has entered the market and is looking to gain market share as their other segments are starting to show limited growth (this is likely to be one of Inmarsat's key growth areas)
- New constellation: Iridium has recently announced the procurement of a new constellation. This constellation will cost between c.\$3.0bn / in addition Iridium has recently received credit facilities from COFACE (French credit agencies) of \$1.8bn to finance their new constellation. The new constellation will start operation by 2017 yet interest expense until then will reach a maximum of \$106m annually (this includes 0.8% annual commitment fee) versus fy'10 estimated EBITDA of \$125m! In addition, Inmarsat has recently announced a KA-band constellation, which will have speeds up to 5x faster than Iridium's new constellation (this is due to differences in spectral efficiency)
- Old constellation: As an added bonus Iridium is currently running a constellation, which was initially estimated to be running until 2008. In 2008, the lifetime of the satellites was increased to 2014 (without a plausible explanation). I believe that there could be a servicing gap for Iridium as the new constellation is only fully operational by 2017 & the old constellation could stop working any day as we are already 2 years beyond initial assessment of lifetime value

Running through thesis

New competition in handset / pricing implications:

- Inmarsat (leader in satellite data with particular focus on maritime & on-the-go data) has recently entered the handset / satellite voice market
- The key to understand here is that any additional traffic that Inmarsat manages to monetize over its satellite constellation is margin accretive simply because there is no significant additional cost connected with that traffic (as the network is already there, capacity is available). Thus, in essence this means that Inmarsat can price their voice product in a very competitive manor as any additional traffic is value accretive
- There are two implications:

o a) Inmarsat chose to make no margin on their handsets (selling this at \$500 versus \$1,200 on Iridium)

o b) Inmarsat (in my view) is likely to become more aggressive during next year as handset will become one of their major growth drivers and hence pricing in voice likely to become more competitive

- Iridium implications from a) & b) above:

o a) Iridium will have to lower handset prices in order to keep customers. Two key observations:

1) A satellite handset customer typically keeps his / her phone for 4 years (i.e. 25% churn annually). This means that in a worst case scenario Iridium could lose 25% of their customers within a year

2) It is important to factor in the network capacity filling notion. A customer that Iridium loses is not being offset by lower overall costs (i.e. there is no additional cost for adding / losing a customer / this is a very high operational leverage business, which swings either way though). As a result it is better to reduce prices in handset than to lose the customer altogether

--> As a result in my view Iridium will have to cut handset pricing to 1a) minimize churn 1b) keep customers. As a result the business will see deteriorating equipment sales. Iridium generates c.\$35 - 45 of EBITDA in the equipment segment, most of which is under threat

b) Inmarsat is a business that is desperately looking for additional growth drivers as current business streams are increasingly looking ex-growth. As mentioned before any additional traffic routed over their constellation is value accretive (as no additional capex required) and hence Inmarsat can be more aggressive in their pricing. In my view their aggressive handset pricing is only the beginning, I think it is likely that they will start to reduce pricing on voice minutes during next year

New constellation:

- Company is sourcing a new constellation at the moment, this will be launched during 2015 - 2017
- As a result of this new constellation this business will run up significant new debt over the next few years (historically Iridium has taken care of this additional debt by writing it off during a bankruptcy...)
- New debt implies additional interest charges where the commitment fee of 0.8% alone implies \$14m of annual interest charges (this is without even borrowing)
- The business will generate \$125m in EBITDA this year and likely less during the next years and hence it appears difficult to see how this business will:

o a) manage to close the financing gap of c. \$1.2bn (i.e. Iridium has received COFACE financing of \$1.8bn yet overall cost of new constellation is anywhere from c.\$3.0bn)

o b) be able to meet any type of covenant requirements, especially with a declining EBITDA

- Inmarsat has recently announced a KA-band constellation: a) this spectrum will allow for 5x faster data speeds b) Inmarsat's constellation will be ready by 2015 c) Inmarsat has above 90% market share in satellite data, difficult to see this change even with new Iridium constellation out there

The key take away with regards to the new constellation is that Iridium will become a highly indebted business over the next few years, where the first potential payout from the new constellation will only accrue in 2017 (this should also address the bull argument of this business being cheap on an EV basis...). In my view, it is unlikely that Iridium will survive until 2017 as pricing pressure mounts / ebitda comes under pressure

Old constellation:

- The current constellation was supposed to be running until 2008
- During 2008 the lifetime of the constellation was increased to 2014 (for no apparent reason, no explanation was given)

As a result, the added bonus on this short is that the current constellation could break down at any point

- This has recently happened to Globalstar, which operates constellation focused at Americas and has had to cancel services due to loss of satellites
- Iridium could face the same fate as Globalstar, if this would happen EBITDA would melt away and any financing capability would be gone & business would like terminate

--> There is a chance that the current constellation will not survive until 2015. Yet the best part about this short is that one does not even necessarily need this to happen in order to make a return on this investment simply because of handset / voice pricing pressure going forward

Catalyst

Inmarsat taking market share in handset market

Inmarsat cutting voice pricing

Iridium cutting handset pricing / losing market share to Inmarsat --> c.\$35 - \$45m of EBITDA at risk over next 12 - 18 months

Over time market will start to get concerned over financing of Next constellation due to EBITDA loss

QUESTIONS

#	Author	Date	Subject	Private
4	bank999	08/10/11 12:32 PM	coface financing	

Do you think there is risk to the coface financing on the new constellation particularly with a possible French downgrade?

3	rjm59	02/14/11 04:33 PM	Geosync vs. low orbit sats	
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Is it correct that Iridium is low orbit (~600 miles up) and Inmarsat is geosync (~25,000 miles up)? I haven't used the phones personally but would think that a low orbit service would be guaranteed by physics to be a better service because of 1) the lower power required so smaller handsets should be possible and more importantly 2) There is a delay for the signal to get to geosync and back so the conversation would sound weird, can't go back and forth in conversation..

2	dallepalle	02/14/11 06:48 AM	RE: Questions	
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David,
Thanks for questions:

Maintenance Capital Expenditures

- | # | Author | Date | Subject | Private |
|---|--------|------|---------|---------|
|---|--------|------|---------|---------|
- 1) OEBITDA excludes Iridium Next related costs. If you look at the last 9 month results you get operating profits of \$22.3m / d&a of \$67.6m i.e. c. \$89.9m of EBITDA. Clearly there are a couple of costs associated with Iridium Next in this EBITDA figure (this is probable a large chunk of the R&D cost of \$14.7m plus probably some other cost increase in other buckets). So yes one should be careful in terms of looking at this measure to understand the respective definitions used, I am using definition as per financial statements.
- 2) Iridium has made accounting changes over the last 12 months and implemented acquisition accounting, and as a result revalued certain inventory items. As a result cost of equipment was revalued from c.\$33m (see unaudited LLC statement) to the quoted \$49.6m, if you look at the last quarter you can see that margins were close to 40% in equipment sales again. Secondly the assumption is relatively simple: you have c.700k handset customers globally. Inmarsat sells at no margin at \$500 / Iridium sells at c.\$1,200. Assuming that Iridium is similarly capable in producing their handset, I would argue that Iridium's phone probably also costs around \$500 (i.e. making a profit of c.\$700 per phone). Global churn is c.25%, assuming that Iridium captures c.30% of this you can get to a profit number of: a) global churn $700k * 25\% = 175k$ b) iridium share 30% (conservative given their current market share) $175k * 30\% = 53k$ c) Implied estimated ebitda: **$52.5k * \$700 = \$36.75m$** (with relatively conservative assumptions --> clearly if I were to assume higher churn that ebitda contribution goes up...
- 3) Inmarsat has only brought out its Isat phone middle of last year not sure how this translates into decades of market share gains for Iridium.... In terms of maritime / aero, Iridium is seen as a very low quality product (from discussions with various big & small shipping operators). In terms of price cuts: I have discussed this with a bunch of the distributors and it appears that currently the Inmarsat phone is being pushed stronger, also I wonder why Iridium would be the preferred option once it starts to put down its handset pricing also remember that Iridium is the clear market leader in handset it is for them to loose not to gain. The other thing I should mention is that there will be pressure on voice minute pricing as well (going back to the filling the network notion), which implies that there could be pressure on service revenues (which I have not even factored in as such)
- 4) M2M: this is a pretty decent business but in my view will not be able to counterbalance equipment / voice minutes pressure over the next 12 months. (note that others are also in this segment / probably most prominently Globalstar another business desperate for increased revenue share). But agreed this is probably the key risk to my thesis

cheers

1 david101

02/13/11 10:47 PM

Questions

Dallepalle,

The crux of your thesis is that **EBITDA will be decreasing** from here, so my questions are:

1. The company is projecting a \$155 million in FY10 OEBITDA. What adjustment are you making to get to your \$125 million figure? How would you adjust the company's projected \$185 million of OEBITDA in FY11?
- 2.
2. How are you calculating \$35-45 million of equipment sale EBITDA? For 9 months of 2010, equipment sales were \$69.2 million and COGS were \$49.7 million. With equipment EBITDA down the past two years and overall EBITDA up, hasn't this become a minor issue?
3. Handset Pricing - Iridium has been gaining market share from Inmarsat for the past decade, even with the higher handset. You are assuming that the price cuts will only help keep customers but won't

#	Author	Date	Subject	Private
			the price cuts also gain them new customers? Given their financing needs, sacrificing one-time EBITDA for growing the recurring EBITDA stream makes sense.	

4. What do you make of Iridium's growth in M2M?

Thanks,
David
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IRIDIUM COMMUNICATIONS INC (IRDM) - \$9.59

Posted on 11/24/10 12:39 PM by spence774

Description: I am posting IRDM as a long again. Last year I posted it as a long and Cross310 posted it as a short right afterwards, sparking a good Q&A.

One year later some questions have been answered and some remain. And it continues to be a company with a very strong bull-bear debate. Please read both write-ups and Q&A to get a full sense of the issues.

Valuation:

EV: \$578.9mm

2010 EBITDA(E): \$155-160mm

EV/EBITDA: 3.7

Capex: about \$10mm/year maintenance capex right now but all the free cash flow will go to building NEXT satellites. The \$10mm estimate is from the first 9 months of 2009 of the predecessor company, before the SPAC merger and before work for NEXT planning began.

Net Cash: \$104.6mm but it too will all go to the NEXT build out.

Insider Buying:

Scott Bok continues to buy stock in the open market. He just bought another \$1mm of stock.

Revenue, EBITDA and Subscriber Growth:

Last quarter revenue, \$94.5mm, grew 12% yoy. EBITDA, \$47.1mm, grew 22.3%. Subscribers, 413K, grew 21.8%

For the year 2010 IRDM estimates it will have \$155-160mm of EBITDA.

Maintenance Capital Expenditures

#	Author	Date	Subject	Private
	Here is the link to the press release: http://finance.yahoo.com/news/Iridium-Announces-pz-4213820451.html?x=0&.v=1			

Financing:

Last year there was a lot of debate about if they would get financing for the NEXT satellites, the next generation of satellites they are going to launch. They did, and on fantastic terms. Their financing is in two tranches: Tranche A \$1,537,500,000 at a fixed rate of 4.96%; and Tranche B \$262,500,000 at a floating rate equal to LIBOR, plus 1.95%. There is no funding gap to pay for the new satellites.

Here is the link to the press release: <http://finance.yahoo.com/news/Iridium-Concludes-Financing-pz-1949516431.html?x=0&.v=1>

Communication with Shareholders:

They have a great web site. Their presentation from June 2010 is excellent.

Here is the link: <http://investor.iridium.com/events.cfm>

Competitive Threat:

One of the short arguments that still remain is that Inmarsat will introduce a better phone for less cost, and a second short argument is that the government will stop using IRDM.

The first point is addressed by IRDM's continued growth, and by a recent survey done by Frost & Sullivan. The survey was commissioned by IRDM so it may be biased. Nonetheless, the results were strongly in favor of IRDM for usability and reliability.

Here is a link to the report:

<http://www.iridium.com/About/IndustryLeadership/SatellitePhoneReport.aspx>

The second point is unlikely given IRDM's current role in government operations around the world, and also contrary to the government business revenue growing last quarter. From the latest Q's press release:

Government service revenue increased by 14 percent during the quarter, as the Company continued to serve as a mission-critical partner for the U.S. Department of Defense and its personnel around the globe. Iridium's voice and data solutions are used by U.S. government customers for critical applications including asset tracking, specialized communications for the special operations and other defense communities and for distributed tactical communications services such as Netted Iridium.

- Government service revenue was \$15.4 million, a 14 percent increase from the prior-year period, primarily driven by growth in satellite handsets and Netted Iridium subscribers.

Maintenance Capital Expenditures

- | # | Author | Date | Subject | Private |
|---|--------|------|---------|---------|
| | | | | |
- Government voice ARPU was \$149 during the third quarter, a 1 percent year-over-year decrease. Voice ARPU was impacted by strong growth in Netted Iridium subscribers. Government M2M data ARPU was \$22 during the period, a 5 percent increase from last year's comparable period.
 - Iridium's government business ended the quarter with 42,000 billable subscribers, which compares to 33,000 for the prior-year quarter and to 38,000 for the previous quarter ended June 30, 2010. M2M data subscribers represented 14 percent of billable government subscribers, an increase from 9 percent during the prior-year period.

Satellite Failures:

One of the shorts' theses was that the satellites were not intended to function after 2008 and would therefore fail before the NEXT satellites were launched. In the Q&A string last year we discussed this and since then there is no new evidence that they will fail en masse and IRDM has signed a number of new deals, including expanding with the government, pointing to the health of their network. Each of their new partners does diligence on IRDM and the health of the network, so we can infer that based on their research they believe the network to be sound. And the Chairman, Scot Bok, is a very smart and successful professional and he would not have purchased an additional \$1mm dollars of stock if there was a problem.

Risks

Satellite failures

Increased competition from rival companies' new satellite constellations.

Decreased U.S. government spending on IRDM's voice and data communications.

Third-party paying customers who place their own equipment on satellites

Catalysts

Increased market penetration into maritime, aviation, transportation, and related industries.

Rapidly expanding margins due to IRDM's largely fixed cost of service and data communications offerings.

Licensed approvals to start providing service into China, Russia, and India.

Catalyst

Increased market penetration into maritime, aviation, transportation, and related industries.

Maintenance Capital Expenditures

#	Author	Date	Subject	Private
			Rapidly expanding margins due to IRDM's largely fixed cost of service and data communications offerings.	

Licensed approvals to start providing service into China, Russia, and India.

Messages...

#	Author	Date	Subject	Private
2	cross310	03/14/11 02:45 PM	EBITDA growth	

Spence - you know where I sit with IRDM and recently re-initiated a position short as it squeezed into the \$9+ range.

Respectfully - I haven't a company in existence that has **EVER grown EBITDA 10% a year for 20 years** - and that's assuming ZERO competition, let alone competition from several competitors (Globalstar in the next 9-12 months).

1	spence774	11/24/10 07:56 PM	RE: question	
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Thanks for the questions. I don't have all my info with me, but here are quick responses:

1. Yes - I expect cash from operations to fund the remainder of the capex needs.
2. I don't expect them to try and compete with Inmarsat on price. They have a superior product that is often vital when needed, so performance matters.
3. ROIC for the NEXT satellites is targeted for mid-teens, and I expect the company to share a lot more info with the market over the next two quarters. They know the short arguments and will seek to address them. Given how far off the FCF from the NEXT satellites is, revenue and margins from the existing business will be good signposts to watch over the next two years.

-

Idea

IRIDIUM COMMUNICATIONS INC (IRDM) - \$8.18

Posted on 12/08/09 04:57 PM by cross310

Iridium Communications (IRDM) was recently written up as a **LONG**, but I wanted to send out the **SHORT** thesis on IRDM.

IRDM is a Ch.11 restart that went public via SPAC (GHL Acquisition Corp.) in Sept. '09. Reportedly, over 25 private equity firms looked at the deal and turned them down - until IRDM received funding from Greenhill-back GHL. Similar to Globalstar (GSAT) before them, IRDM operates a mobile satellite service utilizing a deteriorating low earth-orbiting (LEO) satellite constellation that provides communications to shipping fleets, military and government agencies, news organizations and other users. IRDM plans to replace the current LEO constellation with Iridium NEXT which will require a minimum of \$2.7B to replace - launching by 2014 at the earliest.

#	Author	Date	Subject	Private
			Currently, IRDM is the only player in the market and derives ~35% of its EBITDA from handset sales at a 40% margin (~\$600-700 handset cost). IRDM's wholesales the handset to distributors for ~\$1,000. The distributors then retail the handset to end customers for between \$1,200 to \$1,500. New competition enters the market in 2010. Inmarsat will be the 1st competitor to enter the North American market (the largest) in late Q2 2010. Inmarsat will be offering a handset at ~\$500-600 with aggressive voice/data pricing plans. I believe - at a minimum - IRDM's handset margins will be at risk, or ~35% of EBITDA.	

FACT: There have NEVER been a satellite phone company - including IRDM - that hasn't gone bankrupt (Globalstar, Iridium, ICO Global, and soon-to-be Skyterra and Terrestar). The one notable exception is Inmarsat (ISAT LN) which was funded by a government consortium. I

FACT: Over 20% of IRDM's revenues come from Stratos Global - one of the larger distributors of mobile satellites products & services. Inmarsat completed the purchase of Stratos Global earlier this year. While Inmarsat has allowed Stratos to operate independently and has implemented a fair channel management policy, I have a hard time believing Stratos will be pushing IRDM's handsets aggressively if there is enough channel marketing dollars behind Inmarsat's offering.

INVESTMENT HIGHLIGHTS

1) No Viable Business Case: The total global satellite handheld market is estimated at ~1-1.5mm customers worldwide with total market of ~\$650mm in revenues - of which IRDM has ~350k customers. This is a niche market that isn't growing.

2) Potential Satellite Constellation Failure: IRDM's current satellite constellation has an **estimated useful life until 2014**. Interestingly, when IRDM originally went public in the 90s - this exact same satellite constellation had an **estimated useful life until 2008**. The only difference being then and now - IRDM went bankrupt. IRDM has lost 8 satellites in the last 7 years - since satellite failures follow a 'bathtub curve' - we can expect an accelerating rate of failures going forward.

3) New Competition Entering The Market: IRDM currently owns the satellite handheld market, but new competition is set to enter the market in 2010 with comparable products and aggressive pricing:

- Globalstar (GSAT) will launch new satellites by YE10 and return to the North America market
- Inmarsat (ISAT LN) will have a global lookalike handheld at 1/2 the price by mid-2010
- Terrastar will have a completely new North America service and a strong desire to grab mkt share

To note, Sprint owned ~5% of the original Iridium, and current Inmarsat CEO Andy Sukawaty ran Sprint at that time. In other words, Inmarsat knows the asset really well.

It is also worth mentioning that George Heyward is a major shareholder in Terrestarr and the personal investment manager/major fundraiser for President Obama. I am just speculating here - but I think Terrestar may get special FCC treatment and/or government contracts/funding.

#	Author	Date	Subject	Private
4)			No Satellite Contract In Place: IRDM plans to replace the current constellation with Iridium NEXT - its 2nd generation constellation that it hopes will launch by 2014. Iridium designed NEXT at an estimated cost of \$2.7B at a minimum. However, my checks indicate this price tag may be as much as 20% too low, or ~\$3.5B. IRDM expects to fund a majority of NEXT thru internal free cash flow, as well as through 'piggyback payloads' - utilizing excessive launch capacity to launch add'l, smaller satellites. IRDM has appointed Goldman Sachs to help raise the funding gap. As of now, NO contractor has committed to building Iridium NEXT, but Lockheed Martin and Thales Alenia Space are competing for primary contractor. IRDM expects to announce vendor selection by the end of the year - but I am skeptical on timing and their ability to get funding.	

VALUATION/CONCLUSION

IRDM currently trades ~5x consensus EBITDA, but I believe a significant portion of this is at risk once new competition enters the market in Q2 '10, though I believe 2011 could see negative subscriber growth potentially.

I believe there is a high likelihood the current generation of satellites will FAIL before the new satellites are delivered -- this would be completely event-driven and NOT in my numbers. There is also a decent chance that IRDM is unable to secure financing AT ALL -- again, there is no satellite contract in place and there is no visibility on 'piggyback payloads'.

Clearly, the stock will squeeze if IRDM manages to get financing, but I would be adding to my position on the squeeze. Ultimately, I believe IRDM may end up going 'Chapter 22' -- go bankrupt for the 2nd time.

Catalyst

- 1) No prime contractor in place
 - 2) No financing commitment
 - 3) Satellite failure
 - 4) Competition entering the fray - Inmarsat in Q2 10
-

#	Author	Date	Subject	Private
11	spence774	02/10/10 08:08 AM	How Satellites Fail	

I spoke with the company to address the issue of how satellites fail. According to them, satellites do not fail suddenly and unexpectedly, unless hit by something flying around space.

Their performances attenuates over times, and generally have a slow death. They are all monitored so the company and bankers know the health of each satellite, and would bear significant liability if they falsely represented to the US Govt (who have thousands of soldiers in the Middle East relying on IRDM based communications systems), and investors,

Maintenance Capital Expenditures

#	Author	Date	Subject	Private
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that the network will be operational until the NEXT system is up.

10	spence774	02/09/10 09:51 AM	New Investor Presentation	
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The company just filed a presentation with the SEC addressing many of the issues we are discussing.

<http://sec.gov/Archives/edgar/data/1418819/000119312510024980/dex991.htm>

9	spence774	02/08/10 06:04 PM	RE: RE: Birds falling from the sky	
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Understood but doesn't the mesh nature of the leo network allow for some holes and time for the spares to be positioned correctly and patch up the hole?

8	cross310	02/08/10 05:25 PM	RE: Birds falling from the sky	
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In most cases - they just cease working if its past its useful life. LEO constellation are a bent-pipe network that creates a 'mesh' if you will - if one of the satellites in the mesh fail, there's a hole in the network.

Common causes are solar flares, getting hit with debris, some electrical function, running out of fuel/batteries, etc.

7	spence774	02/08/10 09:21 AM	Birds falling from the sky	
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Cross,

Thanks for posting the opposing view on IRDM. Reasonable minds can differ and I appreciate the healthy debate it sparked.

On the issue of the satellites failing, do you know if they fail suddenly and unexpectedly, so monitoring would not help, or if they get sick and then die in such a way that one can monitor them and know which ones are at risk, and how grave the risk is? The company and underwriters, and some industry veterans, believe they know the health and viability of their satellites, and are exposed to significant liability if they misled the public on this issue.

If you have data that disproves their thesis it would be much appreciated.

Spence

6	wrt233	02/05/10 08:06 PM	Thoughts on Bear Case	
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I am confused on some of the points you bring up in your write-up.

1. You write that Iridium has 350,000 handheld customers. They don't. A large number of the 350,000 subs are data customers. Their runway on new subscribers is therefore larger than you imply. More importantly, the data part of the business is a huge opportunity. It is ludicrous to suggest that despite a market estimated at 3.5 million users (voice and data) that Iridium, with 350,000 customers and \$150 million of EBITDA has "No viable business case".

2. The satellite failure argument is not defensible. There were several reputable underwriters involved in the most recent equity raise. They most certainly researched this issue, as they would be subject to substantial underwriter liability if the network was subject to near term failure. As I am sure you

Maintenance Capital Expenditures

Author Date Subject Private
know, the Iridium constellation has a number of designated "spares" designed to replace satellites upon an individual failures. Do you have any reason to expect near term network failure beyond "a feeling"?

3. Cost of NEXT. Again, both the company and the underwriters would be subject to substantial liability if the \$2.7 billion estimate is materially misleading. How are your "channel checks" better than the company's insights?

4. You suggest that the company is planning of funding some of NEXT through "piggyback payloads"- which you describe as add'l smaller satellites. This is not accurate. What they have said is that they may sell excess capacity on NEXT satellites.

5. Why are you skeptical on the ability to raise financing? I am highly confident of their ability.

5 issambres839 01/29/10 08:17 PM RE: IRDM 2010
Guidance

Why do you think the stock has reacted so sharply to such a small reduction in guidance?

4 cross310 12/14/09 03:08 PM RE: RE: RE: questions

You can pull it off Bloomberg actually - use IRIDQ and change the dates to 'All Dates' - the IPO prospectus is Jun 97 and the secondary is Jan 99.

The revenue trends over the last 3-4 quarters is foreboding. Best case scenario is new competition erodes over 35% of EBITDA in the next 12-18 months, but the funding estimate is dependent on internally generated funds as well as a piggyback payload -- of which there is none currently.

3 issambres839 12/11/09 03:08 PM RE: RE: questions

Do you have a link or can you help me find the original IRDM prospectus?

Thanks for the very interesting analysis.

2 doggy835 12/10/09 11:06 PM Good to see both
sides

IRDM reminds me a little of USU. With all cash flows from the dying infrastructure going into the replacement infrastructure, shareholders are basically serving as venture capitalists for the new venture. The key to the investment is ROI of the new venture. Assuming it even gets off the ground.

1 issambres839 12/10/09 12:28 AM questions

Can you elaborate any further on your "checks" that have mentioned that the price tag is too low for Iridium NEXT?

Also, can you talk more about the "bathtub curve" of the satellite failures? I would think that the failure of the satellites is the big issue here. I would love more info.

Thanks.

IRIDIUM COMMUNICATIONS INC (IRDM) - \$8.29

Author Date Subject Private
Posted on 11/30/09 02:35 PM by spence774
Description

In addition to the recent strong insider buying (CEO Matthew Desch's \$347K worth of stock and Greenhill's Co-CEO Scott Bok's \$849K purchase), IRDM is a compelling LONG because:

Market's misconception due to failures of IRDM's predecessor, Iridium LLC, which filed for Chapter 11 in 1999

- IRDM is growing rapidly, generating profit and has been focusing on an indirect sales model to enter under-penetrated markets. IRDM's revenues have grown at a 27% CAGR over the past five years.
- No longer exclusively focused on selling satellite phone service to retail customers (total revenue breakout: 42% = commercial services, 21% = U.S. gov't services, 37% = voice and data equipment).

Differentiated and competitive satellite network

- Only provider with 100% global coverage of the earth's surface.
- Minimal reliance on ground infrastructure. Better sound quality and lower failure rates versus high altitude satellites.
- Unique ability to provide real-time voice and data communications.

The market is overly concerned about IRDM's "funding gap" for its next-generation satellite constellation

- External funding will not be required until 2012 as 80% of the capital expenditures for the new constellation do not occur until 2012 or thereafter.
- Conversations with former government and Iridium employees suggest that the U.S. gov't will help finance IRDM's "NEXT" satellite launch. The data/voice services provided are a necessity to the government because of security and safety concerns. U.S. military has invested over \$200M into an Iridium-specific gateway and \$100M+ for Iridium hardware.
- Cash flow from operations, vendor financing and hosting equipment for other companies/agencies on its satellites would significantly reduce the "funding gap" and reliance on additional equity/debt financing.

Multiple opportunities to expand into large and under-penetrated markets, products, and geographies

- Current penetration rates for the aviation, maritime and transportation industries is typically below 10%.
- The demand for "Machine-to Machine" (M2M) products and services that allow for tracking and controlling assets is growing rapidly.
- IRDM is looking to enter China, Russia, India and Latin America to sell its services. The company first needs to acquire licensed approvals, which could be accomplished within the next two years.
- "Netted Iridium" is the company's new push-to-talk phone offering that was largely funded by the Department of Defense (approx \$21M). This walkie-talkie-like device should increase commercial and military sales because of its flexibility.

Maintenance Capital Expenditures

#	Author	Date	Subject	Private
	COMPANY DESCRIPTION: Iridium is a satellite operator that provides voice and data communications services. It is the only company to offer 100% global coverage and mostly provides its services to regions of the world that are not served by wireless or wire line networks. Its customer segments include maritime, aviation, government/defense, public safety, mining, forestry, oil/gas and transportation.			

VALUATION:

IRDM trades at around 5x EBITDA and we feel that shares will start to trade more in-line with its closest competitor, Inmarsat (9x EBITDA), once IRDM begins to reduce its "NEXT" funding gap. The chart below highlights different financing scenarios and how we project the equity to perform. Not only should multiple expansion occur as its funding overhang clears, but also as the company continues to achieve over 30% annual revenue growth in key data-driven markets such as maritime and M2M.

MANAGEMENT

- Management's direct ownership is approximately 3%
- Greenhill & Co. (founders of the GHL SPAC that IPO'd IRDM) has approx. a 12% stake in IRDM.
- CEO Matthew Desch and his senior executive team have led Iridium to profitability over the last several years by entering new markets. CFO Eric Morrison has been involved with the Iridium project over the last 14 years.
- We expect that management will act rationally when deciding how to fund its new satellite constellation. It is unlikely that executives would significantly dilute their own equity holdings when presumably they could earn a good return by delaying the launch of "NEXT". By 2014, IRDM could earn over \$700M in free cash flow if we make the assumption that management does not provide any funding for "NEXT".

BALANCE SHEET

- Iridium has \$137M in cash and \$17M in debt.
- IRDM's launch of its "NEXT" satellite constellation starting in 2014 is anticipated to cost \$2.7 billion over the next 7 years (see Appendix).

CATALYSTS

- Increased market penetration into maritime, aviation, transportation, and related industries.
- IRDM narrows "NEXT" funding gap via vendor financing, hosted payloads¹, U.S. gov't funding and/or capital markets.
- Rapidly expanding margins due to IRDM's largely fixed cost of service and data communications offerings.
- Licensed approvals to start providing service into China, Russia, and India.

RISKS

- Satellite failures
- Lack of funding for "NEXT" satellite constellation.
- Increased competition from rival companies' new satellite constellations.
- Decreased U.S. government spending on IRDM's voice and data communications.

Maintenance Capital Expenditures

#	Author	Date	Subject	Private
1			Third-party paying customers who place their own equipment on satellites	

Catalyst

- Increased market penetration into maritime, aviation, transportation, and related industries.
- IRDM narrows "NEXT" funding gap via vendor financing, hosted payloads¹, U.S. gov't funding and/or capital markets.
- Rapidly expanding margins due to IRDM's largely fixed cost of service and data communications offerings.
- Licensed approvals to start providing service into China, Russia, and India.

#	Author	Date	Subject	Private
4	spence774	03/23/10 09:36 AM	updates	

Hi All - Sorry for the delayed response. I have been posting on the string for the short write up of IRDM. The company's latest presentation answers your questions about warrants and other sources of cash/dilution. Here is the link:

<http://investor.iridium.com/secfiling.cfm?filingID=1193125-10-24980>

And I thought the latest press release was positive - they are ahead of plan and have signed up an industry partner - skybitz - which indicates that the satellites are healthy.

The open questions seem to be: funding for nexgen, competition, and satellite failure. At these prices it seems like a great risk/reward, but these are the issues I will continue to monitor.

3	issambres839	01/29/10 08:19 PM	Update	
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Do you have an update for the stock? They gave guidance that appears disappointing.

2	david101	01/13/10 03:58 PM	Warrants	
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Spence,

What are the specifics regarding the warrants in terms of how many, what strike price, etc.?

David

1	spence774	12/01/09 07:29 PM	next gen fcf yield, current satellites	
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1. It is difficult to know but guidance is that the NEXT gen satellites will have a mid-teens fcf yield over their life.

2. I don't have any information about the current satellites failing early.

Now let's relate what we have learned in investing to the broader assessment of capital expenditures through Austrian Business Cycle Theory. See the Sushi Model of Capital Consumption on page 34.

Robert Murphy Discusses Capital Theory—a parable on capital expenditures.

Investors may learn more about the importance of maintenance capital expenditures as they read this piece....to skip the beginning context go to **page 3: A Sushi Model of Capital Consumption**.

As I (Robert Murphy) have read countless analysts, including professional economists, offer "solutions" to the financial crisis, I have become more convinced of the importance of capital theory. You see this with the dichotomy people keep drawing between the financial markets and the "real economy," a distinction that is useful for some purposes but which in this context often reinforces the idea that the stock market is really just a casino.

When the Paulson Plan was first being debated, even sharp, free-market thinkers who are otherwise very solid were recommending instead that "bank recapitalization" was the way to fix things. But if our troubles stem from a diversion of real resources into the housing sector — if too many and too big homes were built at the expense of other possible uses for those inputs — then government financial transfers per se won't do anything except redistribute the losses.

Once we understand how our present problems are due to a Fed-induced distortion in the capital structure, it becomes clear that the *worst* recommendation is for the Fed to cut interest rates and pump in ever more "liquidity." It was artificially cheap credit that fueled the housing boom in the first place. Greenspan brought the federal funds target rate down to a ridiculous 1 percent — meaning the interest rate was actually negative, once we adjust for price inflation — and held it there for a year. He did this in order to (apparently) obviate the need for a harsh recession in the "real economy" after the dot-com crash. But in fact he sowed the seeds for our present crisis. If Bernanke continues shoveling in hundreds of billions to needy bankers, five years from now Americans (and the rest of the world) may look back fondly on the present the way the 2001 downturn now seems like a minor inconvenience.

Krugman and Cowen Ridicule the Austrian "Hangover" Theory

Rather than start from scratch, in this article I will illustrate the importance of a solid theory of capital by showing how very intelligent economists — one of whom is now a Nobel laureate — make elementary mistakes in their critique of Austrian business cycle theory (ABCT). For the sake of brevity, I won't recapitulate the theory here; in the links above you can see my own watered-down expositions, or go here for Roger Garrison's amazing PowerPoint presentation, or here for a more comprehensive introduction. Now then, assuming the reader understands the basic Austrian story, let us quote Tyler Cowen's recent discussion of Paul Krugman's *Slate* critique of ABCT:

[Paul Krugman:] Here's the problem: As a matter of simple arithmetic, total spending in the economy is necessarily equal to total income (every sale is also a purchase, and vice versa). So

if people decide to spend less on investment goods, doesn't that mean that they must be deciding to spend more on consumption goods — implying that an investment slump should always be accompanied by a corresponding consumption boom? And if so why should there be a rise in unemployment?

[Tyler Cowen commenting on the above quote:] But I think the point is more effective in reverse. Why should the boom be a boom in the first place? The shift toward investment goods, and thus away from consumption goods production, should mean falling real wages, not rising real wages. In other words, the Austrian theory doesn't generate the very high degree of comovement found in the data.

These are actually two separate points; i.e., Cowen did more than simply "reverse" the argument, he slightly changed the point. To help the reader understand my response, let me paraphrase (what I take to be) Krugman's and Cowen's similar (but distinct) objections to the Mises-Hayek theory.

The basic Austrian story is that during the artificial boom, workers' labor and other resources get channeled into investment projects that aren't compatible with the overall level of real savings. Sooner or later, reality rears its ugly head, and the unsustainable projects have to be abandoned before completion. Entrepreneurs realize they were horribly mistaken during the boom, everybody feels poorer and slashes consumption, and many workers get thrown out of jobs until the production structure can be reconfigured in light of the revelation.

Now then, Krugman is saying that this story doesn't make sense. We can stipulate that certain producers (such as builders) expanded too aggressively in a boom, and then they suddenly discover that their customers no longer want to buy their products (urban office buildings, let's say). But, **Krugman explains, people in the economy have to spend their income somewhere. If the income isn't going towards \$10 million office buildings, it must be getting channeled into movie tickets, or electric generators, or copies of Peter Schiff's book.** So it's not at all obvious, Krugman concludes, why massive *unemployment* should accompany the onset of the "hangover" from the credit binge. The jobs destroyed in the "higher-order" (in Austrian jargon) stages ought to be offset by newly created jobs in the lower-order stages. (*John Chew: Krugman has no clue about the structure of production—production takes TIME*).

Tyler Cowen's objection is similar, but as I said, it's not quite the same. Cowen wants to know why people should feel rich during the Fed-induced boom, as the Austrians allege. In fact, because workers and materials are shifted into producing higher-order goods like tractor trailers and orange cones for road crews, the fact of scarcity implies that there should be *fewer* consumption goods (TVs, steak dinners, sports cars) being cranked out when the boom first sets in. If fewer consumption goods are being produced, then per capita real income has to fall, which again is the opposite of what the Austrians claim.

I have done my best to paraphrase what I understand to be Krugman's and Cowen's points. I must confess that even while typing out the above, the non sequitur in each objection jumped out at me. For Krugman, his argument relies on a static conception of income and spending.

Just using that accounting tautology — without indexing for time — Krugman could also argue that real income can *never* change in an economy, even if the government announced that the most productive 10% of workers in every firm would be shot. (After all, total income would still equal total spending.)

As for Cowen, he seems to be assuming that "real income" is equivalent to "real consumption." I don't know what to say except, "No it isn't." If a worker gets a job in a silver mine and gets paid in ounces of silver that he stores in his basement, he can have very high "real wages" even if his consumption is very low. Let's assume that he meant to say that ABCT makes us expect real consumption (not income) to fall during the boom period. Cowen's point is that this doesn't match with the data. During the boom, we see increased investment in new (and more "roundabout" in Austrian lingo) projects, *and* we see workers getting paid more and hence buying more consumer goods. But shouldn't this be impossible, Cowen asks, if, as the Austrians claim, during the boom, resources are pulled away from consumption goods (like iPhones) and instead are devoted to the production of investment goods (like tractor trailers)? In the next section we'll see what Cowen is overlooking.

A Sushi Model of Capital Consumption

Above I've pointed out some of the basic flaws in Krugman's and Cowen's arguments. (Other Austrians have responded to Krugman in the past. See the replies of [Garrison](#) and [Cochran](#).) More generally, they are ignoring the all-important notion of *capital consumption*. This is why one needs to understand capital theory, as pioneered by Carl Menger and Eugen von Böhm-Bawerk, in order to make sense of what the heck just happened in the US economy. Any talking head on CNBC who doesn't understand capital consumption is going to give horrible policy recommendations.

When thinking about this article, I went back and forth. I have decided that I should spell out a "model" of intermediate complexity, because if I simplify it too much, it might not really click with the reader, but if I go overboard with it, no one in his right mind would finish the article. Without further ado, **let's examine a hypothetical island economy composed of 100 people, where the only consumption good is rolls of sushi.**

The parable below will help an investor understand the importance of maintenance capex.

The island starts in an initial equilibrium that is indefinitely sustainable. Every day, 25 people row boats out into the water and use nets to catch fish. Another 25 of the islanders go into the paddies to gather rice. Yet another 25 people take rice and fish (collected during the previous day, of course) and make tantalizing sushi rolls. Finally, the remaining 25 of the islanders devote their days to upkeep of the boats and nets. In this way, every day there are a total of (let us say) 500 sushi rolls produced, allowing each islander to eat 5 sushi rolls per day, day in and day out. Not a bad life, really, especially when you consider the ocean view and the absence of Jim Cramer.

But alas, one day Paul Krugman washes onto the beach. After being revived, he surveys the humble economy and starts advising the islanders on how to raise their standard of living to American levels. He shows them the outboard motor (still full of gas) from his shipwreck, and they are intrigued. Being untrained in economics, they find his arguments irresistible and agree to follow his recommendations.

Therefore, the original, sustainable deployment of island workers is altered. Under Krugman's plan for prosperity, 30 islanders take the boats (one with a motor) and nets out to catch fish. Another 30 gather rice from the paddies. A third 30 use the fish and rice to make sushi rolls. In a new twist, 5 of the islanders scour the island for materials necessary to maintain the motor; after all, every day it burns gasoline, and its oil gets dirtier. But of course, all of this only leaves 5 islanders remaining to maintain the boats and nets, which they continue to do every day. (If the reader is curious, Krugman doesn't work in sushi production. He spends his days in a hammock, penning essays that blame the islanders' poverty on the stinginess of the coconut trees.)

"Any talking head on CNBC who doesn't understand capital consumption is going to give horrible policy recommendations."

For a few months, the islanders are convinced that the pale-faced Nobel laureate is a genius. Every day, 606 sushi rolls are produced, meaning that everyone (including Krugman) gets to eat 6 rolls per day, instead of the 5 rolls per day to which they had been accustomed. The islanders believe this increase is due to use of the motor, but really it's mostly due to the rearrangement of tasks. Before, only 25 people were devoted to fishing, rice collection, and sushi preparation. But now, 30 people are devoted to each of these areas. So even without the motor, total daily output of sushi would have increased by 20%, assuming the islanders were equally good at the various jobs, and that there were plenty of fish and rice provided by nature. (In fact, the contribution of the motor was really only the extra 6 rolls necessary to feed Krugman.)

But alas, eventually the reduction in boat and net maintenance begins to affect output. With only 5 islanders devoted to this task, instead of the original 25, something has to give. The nets become more and more frayed over time, and the boats develop small leaks. This means that the 30 fishermen don't return each day with as many fish, because their equipment isn't as good as it used to be. The 30 islanders making sushi are then in a fix, because they now have an imbalance between rice and fish. They start cheating, by putting in smaller pieces of fish into each roll. The islanders continue to get 6 rolls per day, but now each roll has less fish in it. The islanders are furious — except for those who are repulsed by the idea of ingesting raw fish.

Being a trained economist, Krugman knows what to do. He suggests that 2 of the rice workers and 2 of the sushi rollers switch over to help the fishermen. Now with 34 workers, the islanders are able to catch almost as many fish per day as they were in the previous months, even though they are now using tattered nets and dilapidated boats. Krugman — being very sharp with numbers — moved just enough workers so that the fish caught by the 34 islanders matches up perfectly with the rice picked by the remaining 28 islanders who go to the paddies every day. With this amount of fish and rice, the 28 workers in the rolling occupation are able to produce 556 sushi rolls per day. This allows everyone to consume about 5 and a half rolls per day, with a bonus roll left over for Krugman.

The islanders are a bit concerned. When they first followed Krugman's advice, their consumption jumped from 5 rolls to 6 per day. Then when things seemed to be all screwed up, Krugman managed to fix the worst of the discoordination, but still, consumption fell to 5.5 rolls per day. Krugman reminded them that 5.5 was better than 5. He finally got the crowd to disperse by talking about "Cobb-Douglas production functions" and drawing IS-LM curves in the sand.

Because this is a family-friendly website, we will stop our story here. Needless to say, at some point the 5 islanders devoted to net and boat production will decide that they have to cut their losses. Rather than trying to maintain the original fleet of boats and original collection of nets with only 5 workers instead of 25, they will instead focus their efforts on the best 20% of the boats and nets, and keep them in great shape. At that point, it will be physically impossible for the islanders to prop up their daily sushi output. In order just to return to their original, sustainable level of 5 sushi rolls per person per day, the islanders will need to suffer a period of privation where many of them are devoted to net and boat production. (We can only hope that Professor Krugman has been rescued by the Swedes by this time.)

The 5 people looking for ways to synthesize gasoline and motor oil will have to abandon that task, because it was never appropriate for the islanders' primitive capital structure. The islanders will of course discard the motor brought to the island by Krugman once it runs out of gas.

Finally, we predict that during the period of transition, some islanders will have nothing to do. After all, there will already be the maximum needed for catching fish with the usable boats and nets, and there will already be the corresponding number of islanders devoted to rice collection and sushi rolling, given the small daily catch of fish. There would be no point in adding extra islanders to boat and net production, because then they would end up building more than could be sustained in the long run. Hence, the elders rotate 10 people every day, who are allowed to goof off. They could of course go try to catch fish with their bare hands, or go gather rice that would just be eaten in piles by itself, but everyone decides that this is a waste of time. Given the realities, it is decided that during the transition, 10 people get the day off, even though everyone is hungry. That is just how bad Krugman's advice was.

Conclusion

As our simple story illustrates, in modern economies workers use capital goods to augment their labor as they transform nature's gifts into consumption goods. Because of the time structure of production, it is possible to temporarily boost everyone's consumption, but only at the expense of maintaining the capital goods (the boats and nets), which are thus "consumed." At some point, engineering reality sets in, and no "stimulus" policies can prevent a sharp drop in consumption.

Although the story of the sushi economy was simplistic, I hope that it illustrated essential features of a boom-bust cycle. When the islanders first implement Krugman's advice, they all feel richer. After all, they really are eating 6 rolls per day instead of 5; there is no arguing with results. And they would have no reason to suspect an unsustainable restructuring, either: after

all, they are using a new outboard motor. This is analogous to the arguments about the "New Economy" during the dot-com boom, or the confidence placed in the new financial instruments used during the housing boom. During every boom, people can always come up with reasons that "this time it's different."

In the sushi economy, this initial prosperity was illusory. Although there were indeed benefits from the new technology, the bulk of the extra consumption was being financed through capital consumption, i.e., by allowing the boats and nets to deteriorate. This is analogous to Americans' consuming a massive amount of imported consumption goods during the housing boom, because they erroneously thought their rising house values would more than compensate. In other words, had Americans realized that their real-estate holdings would plummet in a few years, they would not have consumed nearly as much. They were consuming capital without realizing it, just as the islanders didn't realize that their extra sushi consumption was largely financed through neglect of their boats and nets.

Note too that this aspect of the story answers Cowen's objection: people consume more during the boom — i.e., the villagers eat more sushi per day — even while new, unsustainable investment projects are started. (In our sushi economy, the unsustainable project was looking for gasoline for the newfangled outboard motor.) Cowen is right that a *sustainable* lengthening of the capital structure initially requires a reduction in consumption; what happens is investors abstain and plow their savings into the new projects. But during a central-bank-induced boom, there hasn't been real savings to fund the new investments. That's why the boom is unsustainable, but it also explains why consumption increases at the same time. It's true that this is impossible in the long run, but in the short run it *is* possible to increase investment in new projects, and to increase consumption at the same time. What you do is neglect maintenance on critical intermediate goods, just as our islanders were able to pull off the feat for a few months. A modern economy is very complex, and it can take a few years for an unsustainable structure to become recognized as such.

Finally, our sushi economy showed why unemployment increases during the retrenchment. People don't like to work; they would rather lounge around. In order for it be worthwhile to give up leisure, the payoffs from labor have to be high enough. During the "recession" period, when the islanders had to cut way back on output from the fish, rice, and sushi-roll "sectors," there weren't 100 different tasks worth doing. In our story, we stipulated that only 90 people could be usefully integrated into the production structure, at least until the fleet of boats and supply of nets start getting restored, allowing more of the "unemployed" islanders to once again have something useful to do.

In the real world, this also happens: during the recession following the artificial boom period, resources need to get rearranged; certain projects need to be abandoned (like hunting for gasoline in the sushi economy); and critical intermediate goods (like boats and nets) need to be replenished since they were ignored during the boom. It takes *time* for all of the million-and-one different types of materials, tools, and equipment to be furnished in order to resume normal growth. During that transition, the contribution of the labor of some people is so low that it's not worth it to hire them (especially with minimum-wage laws and other regulations).

The elementary flaw in Krugman's objection is that **he is ignoring the time structure of production**. When workers get laid off in the industries that produce investment goods, they can't simply switch over to cranking out TVs and steak dinners. This is because the production of TVs and steak dinners relies on *capital goods* that must have already been produced. In our sushi economy, the unemployed islanders couldn't jump into sushi rolling, because there weren't yet enough fish being produced. And they couldn't jump into fish production, because there weren't enough boats and nets to make their efforts worthwhile. And finally, they couldn't jump into boat and net production, because there were already enough islanders working in that area to restore the fleet and collection of nets back to their long-run sustainable level.

People in grad school would sometimes ask me why I bothered with an "obsolete" school of thought. I didn't bother citing subjectivism, monetary theory, or even entrepreneurship, though those are all areas where the Austrian school is superior to the neoclassical mainstream. Nope, I would always say, "Their capital theory and business-cycle theory are the best I have found." Our current economic crisis — and the fact that Nobel laureates don't even understand what is happening — shows that I chose wisely.

As a recap:

The artificially low interest rates stimulate venture capital (LT investment) and consumer good production (ST investment), stretching the economy at both ends at the expense of the middle (capital maintenance, or medium term investment). If the government tries to keep the boom going by continually pumping in new money, the under-maintenance of existing capital will eventually impinge on the economy's ability to keep consumers supplied with current consumables. Alternatively stated, market forces will eventually reallocate resources away from venture capital and current consumables toward capital maintenance, thus ending the boom.

END