

Lecture 6- Pre-lecture reading

Profit and Loss- An Intro to Corporate Finance

We have seen that the number of channels we get determines the cost of our system, but how does that relate to what users must pay for service, and whether we will be profitable? To understand these connections, we need to understand something about the financial reports that companies use, if only in the simplest terms. We will begin with a discussion of the structure and purpose of the “official” financial reports that companies file quarterly and annually. Then we will create a simpler version of those reports that we will apply to cellular systems throughout this course to better understand why some strategies are desirable and why others may be disastrous.

The importance and structure of financial reports

In a simpler time, and to some extent today, small businesses have been created and operated by individuals, using their own money and their own “sweat”. They spent what was necessary for “permanent” assets like tools and equipment, and expenses like employees and supplies. If there was money left over (what we will call profit) it was their money. They could mix it with other money (like their personal savings) and spend it however they wanted. A smart owner would have a clear understanding of how the business was doing, but there was no reason to file reports of any specific kind. In some (admittedly rare) cases, the business owner might even have a non-financial purpose in operating the business.

Over the last few centuries businesses have grown increasing larger and need more “capital” to achieve their goals. That capital is generally provided by “shareholders” who then own a fraction of the company (based on the amount they have invested). Additional investments are made by “bondholders” who loan money to the company for a promised interest payment but who have no ownership. In today’s world, experienced stockholders and bondholders will typically invest small amounts in hundreds or even thousands of companies. Most are investing through “mutual funds” (to be discussed toward the end of the course) and don’t even know what companies they have invested in, much less how the individual companies are doing, but they care a great deal about the total value of their investments and how much it increases (or is reduced) every day. Most investors buy mutual funds or work with financial advisors and expect those intermediaries to be paying attention to value of the many companies they own. Some simply buy “index funds” that buy shares in all companies in some category of companies (or even in all companies).

Investors in the stock market have seen their investments grow an average about 10% a year over the last century, but results are very unpredictable in the short term. They may see exciting gains in one year and frightening losses in another year, so they need to expect a long-term gain like 10% to make the risk seem worthwhile, and they need to trust that the profits a company reports are true and real (for example, was the money really lost or did someone steal it?). The economies of modern countries depend on the confidence of investors (their willingness to put **most of their wealth** into companies they **hardly know** and can’t possibly understand). To create this confidence many laws have been passed to prevent unethical behaviors and to require standardized financial reporting that has been verified by independent auditors as following GAAP (Generally Accepted Accounting Procedures).

The two most significant reports are the **Balance Sheet**, which shows how much has been invested and how that investment has been used, and the “**Results of Operations**” (commonly called the **Profit and Loss**, or **P&L**), which keeps track of revenues and expenses and calculates profit. The reports are related, since the profit shown on the P&L is the stockholders’ reward for the investment shown on the Balance Sheet.

The difference in financial reports for accountants and strategists

The laws that govern financial reports have to cover all sorts of complex situations, and it becomes more important for reports to be legally precise than to be logically understandable. The accountants who create the reports, and those who audit the reports, and those who study the reports for investment purposes are highly trained, but the reports are difficult for the untrained to understand. The strategist is not bound by law to follow exact rules and can use much simpler calculations. For a strategist it is more important to understand a variety of inputs (e.g., technology, economics, competition and politics) so it is rare to be expert in all that is involved. Moreover, a strategist who is expert in financial accounting might be drawn into strategically irrelevant minutia and not see that a different issue is more important in a particular situation. When we observe that the investment in a cellular system is simply the number of base stations times \$1M, we are being less accurate but are perhaps more likely to understand a strategic situation. Having an exact understanding of the profit can take away from understanding the importance of the number of channels we will need to compete. Understanding the importance of the number of channels we need to compete can take away from understanding when the real problem is a political resistance to our monopoly. As strategists, we want to understand the most important things in the simplest possible ways, so we are more likely to recognize what is most important in a given situation.

Another big difference between the accountant's and the strategist's approach to financial accounting is that the accountant is describing things that have actually happened in the past, while the strategist is predicting what will happen in the future. The reports look similar, but the strategist would use a simplified imitation of a financial report to decide whether to invest in a new cellular system, while the accountant is reporting exactly what an existing system earned in the last year. To clarify this issue, we will now create a simplified Balance Sheet and P&L to answer a strategic question that was discussed in the last lecture. We will calculate the monthly charges that service providers would need to collect for cellular service for three different cases (a monopoly service with all 800 channels; two competing systems with 400 channels each; and four competing systems with 200 channels each).

Creating a simple Balance Sheet for a cellular system

The Balance Sheet for a cellular system will be quite simple. We have already estimated (in the previous lecture) that a monopoly system with 800 channels and a 7-cell reuse pattern would support about 2000 users per cell. A system with 400 channels would therefore support about 1000 users per base station and a system with 200 channels would support about 500 users per base station, so it will be easy to calculate the number of cells (base stations) needed for each system. The assets of the company will simply be calculated as \$1M times the number of base stations.

In all three cases we will assume that there are 2M paying users in the area served (either 2M users in one monopoly system, or two competitors with 1M users each, or four competitors with 500K users each. Case 1 (the monopoly, with 800 channels and 2000 users per cell) would require 1000 cells to serve 2M users. Its investment would therefore be \$1B, which would be used to pay for 1000 base stations worth \$1B, and we would find that information on the Balance Sheet.

That \$1B could be provided by some combination of stockholders and bondholders, but for simplicity we will always assume 100% of the investment is made by stockholders (we will discuss financing with bonds in lecture 24 for completeness). The stockholders' investment (sometimes called "equity" or "shareholders' equity") is therefore the same as the assets, or \$1B. This is shown on our hypothetical balance sheet (slide 7, below). [Equity is provided in exchange for

“shares” of “stock” so the terms “shareholders” and “stockholders” become interchangeable.] In all our examples, assets will be the same as shareholders equity (the shareholders equity is used to buy the assets (in this case, the base stations). We are approximating the cost of the base stations and ignoring things like the central switch. The accountant would have it all (to the penny).

Students should not skim through the resulting calculations. They are simple calculations arithmetically but involve a basic understanding that will be the basis for much of the strategy that follows. They need to be fully understood, so that the calculations become effortless and intuitive over time.

Case 1: Estimating the monthly service charge for a monopoly system with 800 channels serving 2M users

Step 1: Creating a hypothetical Balance Sheet

Balance Sheet	
Users in this system	2M
Channels in this system	800
Users/cell	2,000
Number of cells	1,000
Assets (1000 cells)	= \$1B
Shareholders equity	= \$1B

Creating a simple P&L Sheet for a cellular system

The P&L (Profit and Loss) statement is used by accountants to calculate a precise value for the company's profits over a period of time (generally a year). The arithmetic is simple.

$$\text{Revenues} - \text{Expenses} - \text{corporate income tax} = \text{Profit (also called Earnings)}$$

Profit can go to the stockholders (who own the company) as cash “**dividends**” or can be reinvested to provide **growth** (more base stations) that will create even more profit for the investors in later years. Either way, the profit benefits the investors; it is why they invested. Unlike “money in the bank” that pays interest with no risk, stockholders are taking a risk and will expect a higher return as a result. In general, we will assume that the investors are expecting a 10% annual return on their investment, but case 1 is a monopoly, so it is a bit different. Monopolies are less risky since they have no competition. Without competition they could charge whatever they wanted and earn unfair profits. To prevent this, they are regulated and allowed a lower profit than the 10% we are assuming for companies with competition. The AT&T monopoly was only allowed to make a profit of about 8%, which we will assume in case 1.

The accountants that produce a P&L would have detailed and exact values for revenues, expenses and taxes for the past year, and would work “down” from revenues and expenses to calculate an exact **actual profit** (which might be higher or lower than 8%). In this case we, as strategists, are asking **what monthly charges will be needed to provide that desired 8% profit**, so we will be working “up” from that **desired** profit to calculate the monthly charges that would be needed to get that 8% profit. (See slide 8, below)

Step 2: Beginning the simple P&L by entering the desired profit

Balance Sheet		P&L	
Users in this system	2M	Desired Revenue per user = ?	
Channels in this system	800		
Users/cell	2,000	Desired Revenues = ?	↑
Number of cells	1,000	expected Expenses	
		SG&A = ?	
		10% Depreciation = ?	
Assets (1000 cells) = \$1B		BT Earnings =	
		33% Tax =	
Shareholders equity = \$1B		Desired Profit \$80M	
		(8% return on equity)	
		Monopolies are allowed less profit	

Having calculated the desired profit (after taxes), the next step is to calculate what the Before Tax Earnings needed to be (before the corporate income tax). For decades the corporate tax rate in the US was 35%, which we have approximated as 1/3 in this course. Recently it was reduced to 21%. The lower tax obviously results in an increase in a company's profit, but the data and strategies we are discussing are from the period of higher taxes and we will continue to use the old assumption of 1/3. If the tax rate is 1/3rd, the Before Tax Earnings need to be 1.5 x the desired profit, or \$120M (see slide 10, below)

Step 3: Calculating the necessary Before Tax Earnings

Balance Sheet

Users in this system 2M
 Channels in this system 800
 Users/cell 2,000
 Number of cells 1,000

Assets (1000 cells) = \$1B

Shareholders equity = \$1B

P&L

Desired Revenue per user = ?

Desired Revenues = ?

Expected Expenses

SG&A
 10% Depreciation

BT Earnings = \$120M

33% Tax = \$ 40M

Desired Profit = \$80M

(8% return on equity)

Monopolies are allowed less profit

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Expenses for our cellular system (and all companies) include **SG&A** (Salary, General and Administrative expenses, which is mostly the cost of employees, **depreciation**, and **interest** payments on Bonds.

SG&A: We have roughly estimated a table of values for cellular SG&A (see below, and in CANVAS, in the module “CTIA Data and other related files”). Note that the SG&A expense increases more slowly than the number of users, so the SG&A per user is reduced as a system grows. This reflects an “efficiency” advantage for larger companies, as demonstrated in the file “users per employee” in the same module. As systems grew from 1985 to 2012 the number of users per employee for all cellular companies increased from 125 to 1,417, greatly reducing the SG&A cost per user.

As shown in the table below, we estimate that a system with 60,000 users has an SG&A of \$1500/user (which must be paid by users if we want to be profitable). The monthly charges would have to be \$125, just to cover SG&A, so businesses often operate at a loss for the first few years. At 500,000 users, the SG&A per user has fallen to \$500, and the charges to users can be much lower. It is therefore difficult for a service provider with 60,000 users to compete with a service provider with 500,000 users. The smaller provider is forced by competition to charge the same amount as the larger provider and therefore can’t make a profit.

For the example we are working on, a monopoly with 2M users, the total SG&A will be \$500M, as seen below.

Number of Users	Total SG&A	SG&A per user
startup to 30,000	\$50M	\$1,800
60,000	\$90M	\$1,500
125,000	\$125M	\$900
250,000	\$175M	\$700
500,000	\$250M	\$500
1,000,000	\$350M	\$350
2,000,000	\$500M	\$250
4,000,000	\$700M	\$175

10K Reports: A 10K report is a publicly available comprehensive report filed quarterly or annually by a publicly traded company about its financial performance. It is required by the U.S. Securities and Exchange Commission (SEC) and is a useful tool for investors and strategists to find out about the financial health of a company. You can find Verizon's 10K report for 2005 on Canvas in the module "CTIA Data and other related files". It also shows SG&A information (see page 32). [Note that (as shown above the data) the values shown are in millions of dollars. The older Verizon 10K reports are particularly useful because they filed separate 10Ks for their Wireless business. AT&T combines all its businesses in a single 10K, but they do show some separated data for Wireless. The 10K reports typically show a few previous years, so you can see trends like increasing or decreasing profit. We will use the Verizon 2005 10K from time to time in this course (in the homework for this lecture, for example).

Depreciation is an assumed annual expense that is caused by deteriorating assets. The logic is that companies have to spend some of their revenues to repair or replace their aging assets. If they didn't, the company's assets (and the company itself) would gradually disappear. The government doesn't really care how (or even if) the money is actually being spent. It might be saved to replace the assets at a future time, or used to repair the equipment as necessary, or even used to buy new equipment for growth. We will just assume that it is a somewhat complicated expense. The government assumes a 10-year depreciation for cellular base stations. In the current example, that results in an annual depreciation expense of 10% of \$1B = \$100M.

Interest on bonds (or other types of loans) is the final category of expenses. It will be discussed in lecture 20, but is not a factor here since we are assuming 100% of the investment shown on the Balance Sheet is for shares of stock.

The expenses for our current calculation are shown below (Slide 11).

Step 4: Calculating the Expenses (SG&A and Depreciation)

Balance Sheet Users in this system 2M Channels in this system 800 Users/cell 2,000 Number of cells 1,000 Assets (1000 cells) = \$1B Shareholders equity = \$1B	P&L Desired Revenue per user = ? Desired Revenues = ? Expected Expenses= \$600M SG&A = \$500M 10% Depreciation = \$100M BT Earnings = \$120M 33% Tax = \$ 40M Desired Profit = \$80M (8% return on equity) Monopolies are allowed less profit
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We can now calculate the necessary annual revenues to achieve that 8% profit. If we have \$600M in Expected Expenses and we need to be left with \$120M of Before Tax Earnings, our revenues must be \$600M + \$120M = \$720M. Since we have 2M users, our revenues per user must be \$720M / 2M / 12 = \$30/month (slide 12 below)

Step 5: Calculating necessary total revenues and resulting revenue per user per month

Balance Sheet Users in this system 2M Channels in this system 800 Users/cell 2,000 Number of cells 1,000 Assets (1000 cells) = \$1B Shareholders equity = \$1B	P&L Revenue/user /month = \$30 Necessary Revenues = \$720M Expected Expenses= \$600M SG&A = \$500M 10% Depreciation = \$100M BT Earnings = \$120M 33% Tax = \$ 40M Desired Profit = \$80M (8% return on equity) Monopolies are allowed less profit
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If we repeat this rather simple calculation for the case of two competing systems sharing the spectrum (each using 400 channels to serve 1M users) we get the Balance Sheet and P&L shown in slide 13, below, for one of the two systems. We see on the Balance Sheet that the investment is still the same \$1B as for the monopoly case (for half as many users) so the investment per user is doubled. The value of channels is becoming clear. The desired profit is now 10% because these are competing systems with increased risk for investors.

[One of the two systems will probably compete more effectively than the other and we don't know which one, so we are less certain about our profits than we were in the monopoly case. Our risk is increased. As an aside for future discussions of investing, we might buy shares in both companies and accept the average profit they earn rather than hoping for the best result by trying to pick a winner. In investing, this is called "diversification." The investor accepts a lower but more likely profit over a possibly larger but less likely profit.]

SG&A per user (taken from the table) is also greater for the two-competitor case (two smaller, less efficient companies will require more total employees). Depreciation is the same as for the monopoly case, which is twice as much per user than the monopoly case. We can see that the users are expected to provide a higher return for investors (10%) in the face of higher expenses per user. The result is that the monthly charge per user for two competing systems has increased to \$50 (from the \$30 we calculated for a monopoly). Realistically, the higher charge will also result in fewer than 2M total users (slower growth), but we are also ignoring that problem in these calculations.

Case 2: Cellular system with 400 channels and 1M users (This is one of 2 competing systems)

Balance Sheet	P&L
Users in this system 1M	Revenue/user /month = \$50
Channels in this system 400	Necessary Revenues = \$600M
Users/cell 1,000	Expected Expenses = \$450M
Number of cells 1,000	SG&A = \$350M
	10% Depreciation = \$100M
Assets (1000 cells) = \$1B	BT Earnings = \$150M
	33% Tax = \$ 50M
Shareholders equity = \$1B	Desired Profit = \$100M
	(10% return on equity)

\$1B invested (again) but now for only 1M users!

Case 3, in which the 800 channels are divided among four competing systems, is shown on slide 14, below. The balance sheet shows that each of the four systems costs \$1B, and now serves only 500K users. Another way to see this is that \$4B is now being invested to serve the 2M users, compared to \$1B for the monopoly or \$2M for two competing systems. Creating competition is clearly expensive. The SG&A per user is even higher and the Depreciation per user has doubled. Our P&L shows that the monthly service charge must increase to \$83 to give investors a 10% profit. Once again, with an \$83 monthly charge there will be even fewer users (and therefore an even higher SG&A which would make the monthly charges even higher, etc., etc.) but we are ignoring that complexity.

Case 3: Cellular system with 200 channels and 500K users (This is one of 4 competing systems)

Balance Sheet

Users in this system 500K
Channels in this system 200
Users/cell 500
Number of cells 1,000

Assets (1000 cells) = \$1B

Shareholders equity = \$1B

P&L

Revenue/user /month = **\$83**

Necessary Revenues = \$500M ↑

Expected Expenses = \$350M

SG&A = \$250M

→ 10% Depreciation = \$100M

BT Earnings = \$150M

33% Tax = \$ 50M

Desired Profit = \$100M
(10% return on equity)

\$1B invested (again) but now for only 500K users!

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Dividing the channels to create competition significantly increases the monthly charges per user, and higher charges would obviously reduce the “market penetration” (growth rate) of cellular service. On the other hand, it is reasonable to believe that cellular systems would have still attracted many users at \$83 per month, and our calculations suggest that the service providers with 200 channels would be profitable with a monthly charge of \$83 per user. But a good strategist learns to ask, “what if.” Based on what we have learned above, what if a 200-channel system had to compete with a 400-channel system? This will be a HW problem.

We begin to see the importance of financial issues and the usefulness of simple financial calculations in understanding business opportunities and risks. As we will see in a variety of examples, cellular providers have often not understood (or have chosen to ignore) such risks, and they (and their investors) have sometimes paid a high price for their mistakes. For the newcomer

to financial calculations, they may sometimes be confusing, but they are vital to any kind of strategic thinking. Students who give this a little effort will soon realize that the calculations are logical and simple and produce tremendous insight.

In Lecture 7, we will complete our journey through the period of pre-cellular conflict and system design with a look at its politics. In particular, the opposition of the DOJ (Department of Justice) to any expansion of AT&T's monopoly, and Motorola's fear of AT&T's competitive power, would result in years of conflict and delay. In Lecture 8 and Lecture 9 we will take our first look at the 35 years of commercial cellular operation. Lecture 8 will discuss the various ways channels were distributed and the economic results of the FCC decision to "sell" cellular spectrum, beginning in the 1990s. In Lecture 9, we will focus on some important trends in the evolution of cellular service, from pocket phones that created truly "personal" communications, to the era of "digital voice" that made cellular service "universal" and began cellular "data" services like text messaging, and finally to smart phones and internet access that changed the very meaning of cellular service. Lecture 10 will finish this "historic" segment of the course with a movie and discussion.