

Andrews Corporation

by

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Abstract

The purpose of the paper is to explain and illustrate the effectiveness of the various financial tools employed by Team Andrews during the Capstone simulation. Andrews employed trend analysis, where we plotted selected ratios over time to show whether our condition was improving or deteriorating. In addition to that, we benchmarked our results against the average of the six best firms in the sensor industry.

For the students of the University of La Verne's Business Seminar and Strategy class, and every other class I had the opportunity to take at this wonderful school, thank you for teaching me so much.

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Liquidity Ratios

Liquidity ratios show the relationship of a firm's current assets to its current liabilities and a firm's ability to meet its maturing debt (Brigham, 2017). Andrews employed the two most common liquidity ratios: the current ratio and the acid test.

Current ratio:

	Current Assets	Current Liability	Ratio	Industry Average		Current Assets	Current Liability
				Ratio			
2014	20358	48243	0.42	0.42	122148	289698	
2015	37412	50311	0.74	0.74	225080	305026	
2016	53477	32459	1.65	0.85	261857	308813	
2017	51928	34472	1.51	0.79	285044	358599	
2018	56025	32194	1.74	0.87	336217	384968	
2019	52765	28088	1.88	0.83	348951	421829	
2020	51487	54281	0.95	0.86	446632	520512	
2021	95851	33045	2.90	0.96	465708	484117	

The current ratio is calculated by dividing current assets by current liabilities. As assets grow or liabilities shrink the current ratio will become higher. As you can see Andrews ratio grew significantly through 2019. Is that a good thing or a bad thing? Well from a creditor's perspective, they like to see a higher ratio. Certainly from this indicator Andrews was a much better credit risk through 2019 than industry. However, from a shareholder's perspective a high current ratio might mean that Andrews had a lot of money tied up in non-productive assets. Indeed, during the first five rounds of the game Andrews's strategy was to pay down liabilities and retain as much cash as possible to hedge against any "Big AI" emergency loans. We decided to stop offering equity as a means of holding of Big AI at bay, pay a dividend of 2.5% to release some cash, stop making extra debt payments, and taking on long term debt to cover financing needs. We were successfully able to lower our current ratio to a level more in line with industry.

The Acid Test:

	Andrews Corporation			Industry Average		Industry Average		
	Current Assets	Inventory	Current Liability	Ratio	Ratio	Current Assets	Inventory	Current Liability
2014	20358	8617	48243	0.24	0.24	122148	\$51,702	289698
2015	37412	6726	50311	0.61	0.61	225080	\$39,962	305026
2016	53477	926	32459	1.62	0.66	261857	\$57,862	308813
2017	51928	551	34472	1.49	0.48	285044	\$113,219	358599
2018	56025	6736	32194	1.53	0.73	336217	54464	384968
2019	52765	2485	28088	1.79	0.68	348951	63012	421829
2020	51487	7864	54281	0.80	0.70	446632	83620	520512
2021	95851	5444	33045	2.74	0.82	465708	69798	484117

The acid test is calculated by deducting inventories from the current assets and then dividing the remainder by current liabilities. Inventories are the least liquid of a firm's current assets and inventories are the most likely current asset to suffer a loss in a bankruptcy (Brigham, 2017). This is the reason that the capstone game penalized a firm if they had more than two months inventory at the end of each round. Ratios below one indicate that inventories would have to be liquidated to pay off current liabilities should the need arise. For most of the game, Andrews's ratio has been better than industry. In 2020, Andrews reported its highest inventory level and saw its current assets shrink resulting in a ratio below one. By the close of the simulation, this ratio improved dramatically.

Asset Management Ratios

Asset management ratios measure how effectively a firm manages its assets (Brigham, 2017). Andrews used the total asset turnover ratio, the fixed asset turnover ratio, day's sales outstanding, and the inventory turnover ratio.

Total Asset Turnover Ratio:

	Sales	Total Assets	Ratio	Industry Average		Sales	Total Assets
				Ratio			
2014	101073.00	96225.00	1.05	1.05	606438.00	577350.00	
2015	119354.00	105691.00	1.13	1.12	710480.00	634117.00	
2016	127714.00	107183.00	1.19	1.16	796845.00	686522.00	
2017	162277.00	117535.00	1.38	1.15	876548.00	765319.00	
2018	161832.00	115839.00	1.40	1.15	957749.00	833198.00	
2019	211668.00	136192.00	1.55	1.11	1059959.00	958171.00	
2020	241687.00	183107.00	1.32	1.07	1228085.00	1145677.00	
2021	270741.00	204707.00	1.32	1.10	1353788.00	1225698.00	

The total asset turnover ratio is calculated by dividing sales by total assets. Andrews's ratio consistently indicated that Andrews generated more business than our peers given our total asset investment did. The rest of the asset management ratios show specific asset classes that drive this ratio.

Fixed Asset Turnover Ratio:

	Sales	Net Fixed Assets	Ratio	Industry Average		Sales	Net Fixed Assets
				Ratio			
2014	101073	75867	1.33	1.33	606438	455202	
2015	119354	68280	1.75	1.74	710480	409036	
2016	127714	53707	2.38	1.88	796845	424666	
2017	162277	65607	2.47	1.83	876548	480276	
2018	161832	59813	2.71	1.93	957749	496982	
2019	211668	83427	2.54	1.74	1059959	609219	
2020	241687	131621	1.84	1.76	1228085	699047	
2021	270741	108857	2.49	1.78	1353788	759992	

The fixed asset turnover ratio measures how effectively the firm uses its plants and equipment. It is calculated by dividing sales by net fixed assets. Andrews had a much better ratio until 2020. In 2020, Andrews invested heavily in automation and increasing capacity. Andrews saw this ratio rebound in 2021.

Day's Sales Outstanding:

	Receivables	Annual Sales	Ratio	Industry Ratio	Receivables	Annual Sales
2014	8307	101073	30.00	30.00	49842	606438
2015	9810	119354	30.00	30.00	58395	710480
2016	10497	127714	30.00	30.00	65494	796845
2017	13338	162277	30.00	32.17	77245	876548
2018	13301	161832	30.00	30.00	78720	957749
2019	17397	211668	30.00	30.00	87120	1059959
2020	19865	241687	30.00	30.00	100938	1228085
2021	22253	270741	30.00	30.00	111271	1353788

This ratio is used to examine accounts receivable. We calculate DSO by dividing accounts receivable by average daily sales to find the number of days' sales tied up in receivables. Andrews's results are in line with industry and its own policy of 30 days extended to its customers. One interesting note, in 2017 industry had a ratio of 32 days indicating that one or more firms allowed its customers more than 30 days to pay.

The Inventory Turnover Ratio:

	Contribution	Inventories	Ratio	Industry Ratio	Contribution	Inventories
2014	80100	8617	9.30	9.30	480600	51702
2015	86526	6726	12.86	13.20	527512	39962
2016	93638	925	101.23	10.25	593055	57862
2017	125094	551	227.03	6.04	683961	113219
2018	125902	6736	18.69	13.19	718375	54464
2019	145736	2485	58.65	12.18	767485	63012
2020	162613	7864	20.68	10.44	873164	83620
2021	137847	5444	25.32	10.92	762305	69798

This ratio is calculated by dividing costs of goods sold (COGS) except depreciation by inventories. COGS are used rather than sales as sales include costs and profits while inventories are generally reported at cost only (Brigham, 2017). Andrews typically had much lower inventory levels than did industry resulting in a much higher historical ratio. However, this did not always indicate good news for Andrews as in several years Andrews stocked out of sensors. In the case of stock outs, Andrews missed potential sales.

Debt Management Ratios

Financial leverage is defined as the extent that a firm uses debt financing. “This is important for three reasons: (1) Stockholders can control a firm with smaller investments of their own equity if they finance part of the firm with debt. (2) If the firm’s assets generate a higher pre-tax return than the interest rate on debt, then shareholder’s returns are magnified. Of course, shareholder losses are also magnified if assets generate a pre-tax return less than the interest rate. (3) If a firm has high leverage, even a small decline in performance might cause the firm’s value to fall below the amount it owes creditors” (Brigham, 2017). Andrews used the debt to asset, debt to equity, market debt ratio, liabilities to assets, times interest earned ratio, and the EBITDA coverage ratio.

Debt to Asset Ratio:

	Debt	Assets	Ratio	Industry Average			
				Ratio	Debt	Assets	
2014	41700	96225	0.43	0.43	250200	577350	
2015	46133	105691	0.44	0.42	265365	634117	
2016	28020	107183	0.26	0.39	265113	686522	
2017	28020	117535	0.24	0.40	307956	765319	
2018	20850	115839	0.18	0.26	214066	833198	
2019	20850	136192	0.15	0.27	259668	958171	
2020	25000	183107	0.14	0.22	256764	1145677	
2021	25000	204707	0.12	0.23	283686	1225698	

To calculate the debt to asset ratio we divide total debt by total assets. We do not include other liabilities like accounts payable. Andrews had two main types of debt, current debt and long-term debt. Andrew’s debt ratio is substantially lower than industry though industries’ ratio also fell significantly during the time period covered.

Debt to Equity Ratio:

	Debt	Equity	Ratio	Industry Ratio	Debt	Equity
2014	41700	47942	0.87	0.87	250200	287652
2015	46133	55381	0.83	0.81	265365	329091
2016	28020	74724	0.37	0.70	265113	377711
2017	28020	83062	0.34	0.76	307956	406721
2018	25376	83645	0.30	0.75	338374	448231
2019	20850	108103	0.19	0.69	367705	536339
2020	25000	128826	0.19	0.41	256764	625164
2021	25000	171662	0.15	0.38	283686	741580

The debt to equity ratio is calculated by dividing total debt by a firm's total common equity. By 2020, Andrews's ratio showed that Andrews had .19 cents of debt for every dollar of equity. This is substantially lower than industry and indicates that investors shoulder more of risk than do its creditors.

Market Debt Ratio:

	Debt	Market Val Eq.	Ratio	Industry Ratio	Debt	Market Val. Eq.
2014	41700	68500	0.38	0.38	250200	411,000
2015	46133	88409	0.34	0.33	265365	532,850
2016	28020	114123	0.20	0.30	265113	608,688
2017	28020	124051	0.18	0.35	307956	560,026
2018	25376	111186	0.19	0.36	338374	602,044
2019	20850	170141	0.11	0.33	367705	752,079
2020	25000	252221	0.09	0.21	256764	987,222
2021	25000	400496	0.06	0.17	283686	1,348,523

The market to debt ratio is calculated by dividing total debt by total debt plus the market value of equity. Andrews's falling ratio is due to two major factors: Debt decreased and the stock price increased. The stock price reflects the markets perception of a company's prospects for generating future cash flows (Brigham, 2017). Therefore, an increase in our stock price indicates a likely increase in future cash flows.

Liabilities to Assets Ratio:

	Liabilities	Assets	Ratio	Industry		Liabilities	Assets
				Ratio	Ratio		
2014	48283	96225	0.50	0.50	289698	577350	
2015	50310	105691	0.48	0.48	305026	634117	
2016	32460	107183	0.30	0.45	308813	686522	
2017	34473	117535	0.29	0.47	358599	765319	
2018	32194	115839	0.28	0.46	384968	833198	
2019	28088	136192	0.21	0.44	421829	958171	
2020	54281	183107	0.30	0.45	520512	1145677	
2021	33045	204707	0.16	0.39	484117	1225698	

This ratio is calculated by dividing total liabilities by total assets. This ratio shows the extent a firm's assets are not financed by equity. We can see that by 2019, only 21% of Andrews was financed by debt. This indicates once again that shareholders were shouldering most of the risk in financing Andrews. Conversely, Andrews is less leveraged than industry.

Interest Coverage Ratio:

	EBIT	INT Exp.	Ratio	Industry		EBIT	INT Exp.
				Ratio	Ratio		
2014	11996	5421	2.21	2.21	71976	32526	
2015	16464	5727	2.87	2.87	95554	33344	
2016	16349	3815	4.29	3.10	102596	33148	
2017	16905	3815	4.43	2.01	79126	39352	
2018	7807	3317	2.35	2.26	94277	41799	
2019	29512	2919	10.11	2.55	118590	46480	
2020	46839	4568	10.25	3.43	189911	55399	
2021	85674	2650	32.33	4.94	262423	53102	

This ratio is calculated by dividing earnings before interest and taxes by a firm's interest expense. This ratio measures how much operating income can decline before a firm is unable to meet its annual interest costs. The reason EBIT is used is that interest is paid with pre-tax dollars so a firm's ability to pay interest is not affected by taxes (Brigham, 2017). Long-term

bondholders focus on this ratio. Andrews's ratio indicates that operating income can decline by more than 10 times before we could make annual interest payments.

EBITDA Coverage Ratio:

	EBITDA	INT + P	Ratio	Industry Ratio	EBITDA	INT + P
2014	19583	5421	3.61	3.61	117498	32526
2015	24051	12677	1.90	2.24	139483	62371
2016	23062	22174	1.04	1.65	153952	93229
2017	23805	7630	3.12	1.82	131341	72262
2018	14714	3317	4.44	1.58	150196	94840
2019	38599	7445	5.18	1.12	184575	165240
2020	60017	4568	13.14	5.41	268160	49607
2021	97728	2650	36.88	6.88	349690	50818

In contrast to the interest coverage ratio, the EBITDA coverage ratio is used by banks and short-term lenders whose typical loans are 5 years or less. The reason bankers use the EBITDA coverage ratio rather than the ICR is that in the short-term depreciation generated funds can be used to service debt. In the long-term, depreciation generated funds must be reinvested in order to maintain plants and equipment (Brigham, 2017). Andrews's covered its financial charges 36.88 times in 2021, which is well above industry average.

Profitability Ratios

Profitability ratios show the combined effects of liquidity, asset management, and debt on operating results (Brigham, 2017). Andrews focused on net profit margin, operating profit margin, basic earning power, return on total assets, and return on common equity.

Net Profit Margin:

	Andrews			Industry		Andrews	
	Net Income	Sales	Ratio	Ratio	Net Income	Sales	
2014	4189	101073	4.14%	4.14%	25134	606438	
2015	6839	119354	5.73%	5.58%	39628	710480	
2016	7984	127714	6.25%	5.55%	44238	796845	
2017	8338	162277	5.14%	2.88%	25206	876548	
2018	2860	161832	1.77%	3.48%	33343	957749	
2019	16940	211668	8.00%	4.33%	45850	1059959	
2020	26927	241687	11.14%	6.97%	85650	1228085	
2021	52886	270741	19.53%	9.85%	133336	1353788	

This ratio is calculated by dividing net income available to common shareholders by sales. With the exception of 2018, Andrews's net profit margin exceeded industry every year. In 2018, Andrews was constrained by tight capacity and low automation and had to spend a large amount of cash to improve plant and equipment. Those improvements led to a higher net profit margin in subsequent years.

Operating Profit Margin:

	Andrews			Industry		Andrews	
	EBIT	Sales	Margin	Margin	EBIT	Sales	
2014	11996	101073	11.87%	11.87%	71976	606438	
2015	16464	119354	13.79%	13.45%	95554	710480	
2016	16349	127714	12.80%	12.88%	102596	796845	
2017	16905	162277	10.42%	9.03%	79126	876548	
2018	7807	161832	4.82%	9.84%	94277	957749	
2019	29512	211668	13.94%	11.19%	118590	1059959	
2020	46839	241687	19.38%	15.46%	189911	1228085	
2021	85674	270741	31.64%	19.38%	262423	1353788	

This ratio is calculated by dividing EBIT by sales. This ratio shows how a company is performing with respect to operations before the impact expense is considered (Brigham, 2017).

Andrews's investments in 2018 led to substantially higher ratios in higher years.

Basic Earning Power:

	EBIT	Total Assets	Ratio	Industry Ratio	EBIT	Total Assets
2014	11996	96225	12.47%	12.47%	71976	577350
2015	16464	105691	15.58%	15.07%	95554	634117
2016	16349	107183	15.25%	14.94%	102596	686522
2017	16905	117535	14.38%	10.34%	79126	765319
2018	7807	115839	6.74%	11.32%	94277	833198
2019	29512	136192	21.67%	12.38%	118590	958171
2020	46839	183107	25.58%	16.58%	189911	1145677
2021	85674	204707	41.85%	21.41%	262423	1225698

The basic earning power ratio is calculated by dividing EBIT by total assets. This ratio shows the earning power of a firm's assets before taxes and leverage. This ratio makes it easier to compare different firms that have different tax structures and different degrees of financial leverage. As stated earlier, 2018 was a pivotal year for Andrews. The improvement in plant and equipment led to substantial increases in Andrews's BEP in comparison to industry.

Return on Total Assets:

	Net Inc.	Total Assets	Ratio	Industry Ratio	Net Inc.	Total Assets
2014	4189	96225	4.35%	4.35%	25134	577350
2015	6839	105691	6.47%	6.25%	39628	634117
2016	7984	107183	7.45%	6.44%	44238	686522
2017	8338	117535	7.09%	3.29%	25206	765319
2018	2860	115839	2.47%	4.00%	33343	833198
2019	16940	136192	12.44%	4.79%	45850	958171
2020	26927	183107	14.71%	7.48%	85650	1145677
2021	52886	204707	25.83%	10.88%	133336	1225698

Return on total assets is calculated by dividing net income available to common shareholders by total assets. Andrews's high return is driven by our high basic earning power and low interest cost resulting from our below average use of debt.

Return on Common Equity:

	Net Inc.	Equity	Ratio	Industry Ratio	Net Inc.	Equity
2014	4189	47942	8.74%	8.74%	25134	287652
2015	6839	55381	12.35%	12.04%	39628	329091
2016	7984	74724	10.68%	11.71%	44238	377711
2017	8338	83062	10.04%	6.20%	25206	406721
2018	2860	83645	3.42%	7.44%	33343	448231
2019	16940	108103	15.67%	8.55%	45850	536339
2020	26927	128826	20.90%	13.70%	85650	625164
2021	52886	171662	30.81%	17.98%	133336	741580

This ratio is calculated by dividing net income available to common stock holders by common equity. This ratio tells shareholders how their investment is doing. The ROE for Andrews has made substantial improvements over industry.

Market Value Ratios

Market value ratios show the relationship between a firm's stock price to its earnings, cash flow, and book value per share giving management an idea of what investors think of the company's past performance and future prospects (Brigham, 2017). Andrews used the price to earnings ratio.

Price to Earnings Ratio:

	Price	Earnings	Ratio	Industry Ratio	Price	Earnings
2014	34.25	2.09	16.39	16.39	205.5	12.54
2015	43.81	3.39	12.92	13.37	260.25	19.47
2016	50.12	3.51	14.28	13.69	290.7	21.24
2017	54.48	3.66	14.89	22.15	264.92	11.96
2018	48.83	1.26	38.75	18.10	278.7	15.4
2019	68.55	6.83	10.04	16.63	321.7	19.35
2020	101.62	10.85	9.37	11.66	414.19	35.534
2021	161.36	21.31	7.57	10.11	558.39	55.24

The P/E ratio shows how much money investors are willing to pay per dollar of reported profits and indicate growth prospects for a firm. A lower ratio indicates that growth prospects are less for a firm and growth prospects are higher for a firm with a higher ratio. This seems counter intuitive. Andrews had growing sales nearly every year, yet our P/E ratio indicates we are riskier than industry and our growth prospects are less. Andrews was faced with similarly dire results in 2017 and in 2018, Andrews experienced its smallest profits of the simulation. However, Andrews had quite a healthy rebound in subsequent years. Still by the last two years of the simulation, Andrews's P/E ratio is very low compared to industry. Lowering earnings or raising share price would increase this ratio for Andrews. We do not want to lower earnings so

to raise the share price we would have to grow. This would require increasing capacity, spending money on marketing, etc. (all of which would lower earnings).

Du Pont Equation

“The Du Pont equation is designed to show how the profit margin on sales, the asset turnover ratio, and the use of debt all interact to determine the rate of return on equity. Management can use the Du Pont system to analyze ways to improve performance” (Brigham, 2017). The Du Pont equation uses the profit margin ratio and the total asset turnover ratio that we used earlier. The Du Pont equation also uses another ratio called the equity multiplier, which is the ratio of assets to common equity. The Du Pont equation is calculated by multiplying net income/sales times sales/total assets times total assets/common equity. Managers can use the Du Pont equation to complete “what if” scenarios by changing the values of the different ratios to forecast the effect of said changes.

Du Pont Equation

	Net Inc.	Sales	Sales	Total Assets	Total Assets	Common Equity	Ratio	Industry Ratio
2014	4189	101073	101073	96225	96225	47942	8.74%	8.74%
2015	6839	119354	119354	105691	105691	55381	12.35%	12.04%
2016	7984	127714	127714	107183	107183	74724	10.68%	11.71%
2017	8338	162277	162277	117535	117535	83062	10.04%	6.20%
2018	2860	161832	161832	115839	115839	83645	3.42%	7.44%
2019	16940	211668	211668	136192	136192	108103	15.67%	8.55%
2020	26927	241687	241687	183107	183107	128826	20.90%	13.70%
2021	52886	270741	270741	204707	204707	204707	25.83%	10.88%

As you can see, Andrews had a much better ratio in the later parts of the simulation than did industry. We increased assets from 2018 to 2020 by increasing automation, TQM, and plant capacity. Those increases led to increased sales and a greater contribution margin. Had we not made those investments we could not have increased sales. Now if there had been a way to increase sales without making the investments we did, the ratio could improve that way.

However, through 2017 we saw our contribution margin shrinking, capacity needs were growing,

and the market demanded better products at lower prices each year. Our existing plant and equipment could not support that.

AFN and the Percent of Sales Method

The additional funds needed equation, also known as the external funds needed equation, provides a simple way to get a quick and dirty estimate of the additional external financing a firm will need to sustain a projected growth rate. The percent of sales method works by assuming that there is a relationship between sales, assets, and spontaneous liabilities. A firm with no access to external capital has a self-supporting growth rate equal to g when $AAFN$ equal zero. The AFN equation does not indicate whether a firm should finance the growth rate through equity or debt. I had great hopes that using the AFN and percent of sales method would give team Andrews a competitive advantage at the beginning of the game. However, two factors limited this methodology to an academic pursuit only: First, competitive pressure to “win” the game caused Andrews to focus on attaining the highest increase in sales year over year instead of targeting a specific growth rate. Second, accurately forecasting sales was difficult in the early part of the game. Because of the two limiting factors, AFN was not actively used during the game. However, now that we are in the final round I thought it would be fun to project the income statement and balance sheet for fiscal year 2021 and compare the prediction to the actual year-end results.

There are two main methods of forecasting. The first is using the external funds needed equation along with the percent of sales method. This type of forecasting assumes a relationship between spontaneous assets and spontaneous liabilities and sales. In addition, the assumption is made that it is advantageous to maintain the current relationship. This method is useful for one-year forecasts. The main limitation of this method is the idea that the present relationships are not optimal, only the current relationships are examined.

The second method, similar to the first, is to use simple linear regression to find the relationships between sales and the spontaneous assets and spontaneous liabilities using multiple years of data. A more accurate forecast can be generated with a longer history to look at. In addition, this method has the advantage of easily changing the forecasted sales number to examine the effects on the income statement and balance sheet of different hypothetical scenarios. Either method used gives a quick and dirty look at the effects on the balance sheet and income statements. Neither methodology is perfect, both are just tools used by decision makers to help them decide on a course of action.

When we prepare our first-pass forecast, we generally make very basic assumptions. The most common basic assumption is that we want the current or existing financial relationships to be maintained. This is just our starting point. We can and should reevaluate these assumptions in later forecasting passes during the planning process. To use percent of sales model, it requires a sales forecast. This is the one area where a prediction is important. If company has no idea where its sales are headed in the future then percent of sales model should not be used. For this forecast, we are going to use a simple number, \$279,113 million dollars. This number matches what our forecasted sales revenue for the simulation found in the pro forma income statement for the year 2021 on the Capstone simulation.

								Projected	Actual	Difference +/-
Income Statement	2014	2015	2016	2017	2018	2019	2020	2021	2021	
Sales	101073	119354	127714	162277	161832	211668	241687	279113	270741	8372
Variable Costs:										
Direct Labor	28932	32726	38429	56089	57442	59698	59143	75004	50449	24555
Direct Material	42546	45406	48385	62039	60745	76654	89349	100810	98799	2011
Inventory Carry	1034	807	111	66	808	298	944	759	653	106
Total Variable	72512	78939	86925	118194	118995	136650	149436	176573	149901	26672

ANDREWS CORPORATION

Contribution Margin	28561	40415	40789	44083	42837	75018	92251	102540	120840	-18300
Period Costs:										
Depreciation	7587	7587	6713	6900	6907	9087	13178	12512	12054	458
SG&A R&D	0	3055	2768	3198	2979	2723	2039	3105	2251	854
Promotions	4100	5500	6200	6700	6600	7700	8050	9319	8350	969
Sales	4100	6648	7088	7325	7350	8600	9300	10655	10300	355
Admin	778	1003	1406	3056	1918	1897	1595	2413	2465	-52
Total Period Costs	16565	23793	24175	27179	25754	30007	34162	38004	35420	2584
Net Margin	11996	16622	16614	16904	17083	45011	58089	64536	85420	-20884
Other	0	158	265	0	9275	15500	11250	18113	-254	18367
EBIT	11996	16464	16349	16904	7808	29511	46839	46423	85674	-39251
Short Term Interest	0	1068	0	0	398	0	1918	1340	0	1340
Long Term Interest	5421	4659	3815	3815	2919	2919	2650	1674	2650	-976
Taxes	2301	3758	4387	4581	1572	9308	14795	15260	29058	-13798
Profit Sharing	85	140	163	170	58	346	550	575	1079	-504
Net Profit	4189	6839	7984	8338	2861	16938	26926	27574	52887	-25313

								Projected	Actual	Difference +/-
Balance Sheet	2014	2015	2016	2017	2018	2019	2020	2021	2021	
Assets:										
Cash	3434	20876	42055	38039	35988	32883	23758	37491	68154	-30663
Accounts Receivable	8307	9810	10497	13338	13301	17397	19865	22943	22253	690
Inventory	8617	6726	925	551	6736	2485	7864	6377	5444	933
Total Current Assets	20358	37412	53477	51928	56025	52765	51487	66811	95851	-29040
Plant & Equipment	113800	113800	100700	119500	103600	136300	197672	190242	180804	9438
Acc. Depreciation	-37933	-45520	-46994	-53893	-43787	-52873	-66052	-85293	-71948	-13345
Total Fixed Assets	75867	68280	53706	65607	59813	83427	131620	104949	108856	-3907
Total Assets	96225	105692	107183	117535	115838	136192	183107	171760	204707	-32947
Liabilities & O. Equity:										
Accounts Payable	6583	4178	4439	6452	6817	7238	8431	9005	8045	960
Current Debt	0	11359	0	0	4526	0	20850	0	0	0
Long Term Debt	41700	34774	28020	28020	20850	20850	25000	25000	25000	0
Total Liabilities	48283	50311	32459	34472	32193	28088	54281	34005	33045	960
Common Stock	18360	18960	30319	30320	30319	40319	40319	40319	40319	0
Retained Earnings	29582	36421	44405	52743	53326	67785	88507	97436	131343	-33907
Total Equity	47942	55381	74724	83063	83645	108104	128826	137755	171662	-33907
Total Liab. & O. Equity	96225	105692	107183	117535	115838	136192	183107	171760	204707	-32947

Looking at the projected statements and comparing them to the actual results lets us see the advantages and limitations of forecasting this way. We are able to see how accurate the regression was in predicting balance sheet items like total liabilities, plant and equipment, total fixed assets, inventory, and accounts receivable. On the income statement, simple linear

regression accurately predicted profit sharing, short and long-term interest, total period costs, direct materials, and inventory carrying costs. We were not able to predict all categories. The biggest discrepancies were the cash balance and the EBIT. From our earlier analysis, we made the admission that our retained earnings were held artificially high due to worries about “Big AI” emergency loans. However, from a planning perspective the forecasts enable management to make decisions about things like retained earnings.

For example, our first pass look indicated that we would need \$190 million in plants and equipment to support \$279 million in sales in 2021. In fact, Andrews had \$198 million invested in plants and equipment in 2020. Since no new investment in P & E is needed, Andrews might look at ways of addressing the excessive amount it has in retained earnings. Investors expect a company to retain earnings: retained earnings are often the fuel used to support growth, improve efficiency, etc. However, if a company is not growing and is keeping significant amount of earnings then they are going to demand a bigger dividend because the money they are allowing the company to keep is not being used to make them more money (Leona). At this point in the simulation, Andrews is growing and paying a dividend with a 2.5% yield. Since there are thousands of types of sensors, Andrews might look to expand into a new type of sensor product line or buy another firm in a new market segment.

Suppose though that Andrews had inside information in 2020, that two of its main competitors would be exiting their shared market segment leaving Andrews with only three competitors. Andrews CEO wants to capture 50% of the new opportunity. In 2020, the two companies combined sales were \$252,105 million. Andrews CEO targets \$126,000 million in new sales in addition to the \$279,113 million already forecast for a grand total of \$405,166 million dollars. The first thing he wants to know is how much capacity (Plants & Equipment) it

will take to support the new sales goal. In addition, the CEO wants a forecasted income statement and balance sheet. The CFO agrees to have the figure together by the end of the day and the statements by the end of the week. The CFO then goes to lunch and then plays golf since he already has the necessary regression equations on file. For example, the regression equation for Plants and Equipment: $y = .5389x + 39828$. The CFO uses the calculator on his iPhone to see that Andrews needs P & E assets of \$258,172 million. In 2020, Andrews had P & E assets totaling \$197,672. Andrews would need to invest another \$60,500 million to have the Plants and Equipment necessary to support the new sales target. Andrews was projecting only \$37,500 million in cash for 2021 leaving a shortfall of at least \$23,000 million. The CFO reports all of this to the CEO. (OK, I am not going to prepare another balance sheet and income statement for you. You get the idea. I will put all the regression equations in the index.) Andrews's CEO now knows that to pursue the new market opportunity he needs to secure additional funds to address the projected deficit in P & E of \$23,000 million. The various historical regression equations are then used by the CFO to complete the income statement and balance sheet.

References

Brigham. (2017). *Financial Management: Theory and Practice* (14th ed.). Mason, Ohio: South-Western.

Leona, Maluniu. (n.d.). *How to Calculate Retained Earnings*. Retrieved May 25, 2014, from wikiHow Web site: <http://www.wikihow.com/Calculate-Retained-Earnings>

Appendix A

Additional Information

Here are the simple linear equations used to calculate the projected balance sheet and income statements. For simplicity I treated all costs as variable, which is an accepted though more conservative technique. When the left and right side of the balance sheet did not balance I made small adjustments, not statistically significant, in order to balance them. I did simple linear regression for taxes, which would also not be done. I have also included a percent of sales EFN worksheet.

Regression Equations

Balance Sheet Items:

$.079x+15441$ Cash	$.0822x-.3451$ Account Rec	$.0035x+5401$ Inventory	$.5389x+39828$ P/E	$-.234x-19981$ Depreciation
$.0228x+2641.7$ Accounts P.	$.0787x-7401.5$ Current Debt	$-.1104x+46219$ Long Term Debt	$.1613x+3904.5$ Common Stock	$.3864x-8880.2$ Retained Earnings

Income Statement Items:

$.2325x+10110$ Direct labor	$.3388x+6246.3$ Direct Material	$.0004x+647.82$ inventory carry	$.0358x+2519.4$ DPRE	$.006x+1430.3$ SG RD	$.0246x+2452.4$ Promo	$.0292x+2504.5$ sales
$.0063x+654.72$ admin	$.1091x-12338.1$ other	$.0072x-670.08$ short int	$-.0175x+6558.19$ long int	$.0799x-7040.83$ TX	$.003x-262.11$ PS	

External Funds Needed Work Sheet

$$EFN = \frac{A_0^*}{S_0} (S_1 - S_0) - \frac{L_0^*}{S_0} (S_1 - S_0) - (PM)(S_1)(b)$$

S_0 = Current Sales,

S_1 = Forecasted Sales = $S_0(1 + g)$,

g = the forecasted growth rate is Sales,

A_0^* = Assets (at time 0) which vary directly with Sales,

L_0^* = Liabilities (at time 0) which vary directly with Sales,

PM = Profit Margin = (Net Income)/(Sales), and

b = Retention Ratio = (Addition to Retained Earnings)/(Net Income).

Sales Forecast (S_1):	S_0	g		S_1
	241687	0.155		405166
PM	NI	Sales		PM
	149435	241687		0.6183
b	ARE	NI		
	88507	149435		0.592278
A_0	51487			
S_0	241687		0.213032	
S_1	405166			
S_0	241687		163479	<u>34826.21</u>
ΔA_0 - Depreciation	ΔA_0	Depreciation		
	25000	13000		<u>12000</u>
L_0	7000			
S_0	241687		0.028963	
S_1	405166			
S_0	241687		163479	<u>4734.855</u>

PM	0.075	
S₁	405166	
b	0.592277579	<u>17997.81</u>
EFN:		<u><u>24093.55</u></u>

The EFN equation shows a positive number of \$24,094 million in external financing needed to support the projected level of sales. Once again, this is a first pass look. There are many other factors to be considered.

Author Note

I got the idea to calculate the financial ratios manually after discovering that I was unsure as to what drove each ratio. It is one thing to look the statistic for the current ratio and a whole other thing to know that the current ratio is found by dividing current assets by current liabilities. Moreover, a high current ratio indicates that a firm's current assets are growing faster than its liabilities. Conversely, a firm that is having financial difficulty will start to pay its bills more slowly and its liabilities will grow lowering the ratio. Understanding the ratios and what drives the ratios then allowed Team Andrews to make decisions we otherwise would not have made. For example, Andrews P/E ratio was 14.89 in 2017, meaning that investors were willing to pay \$14.89 for every dollar of earnings. Investors were willing to pay industry \$22.15 for every dollar of earnings to industry. Why were investors willing to pay more to industry than to Andrews? The answer is that P/E ratios are higher for firms with strong growth prospects and lower for riskier firms. In fact, 2018 proved to be one of Andrews's leanest years; we recorded our smallest profit of the simulation. The situation was that our contribution margin was shrinking after four rounds of price cuts, we were constrained by capacity, and we had not automated. Therefore, we sold our traditional product and used the proceeds to launch a new high-end product. We also, sold some of our excess capacity in our smaller product lines and bumped up automation a bit. We would not have made these decisions had we not learned what drove the P/E ratio.

All mistakes in this document are the author's alone.