

Equity Valuation Project

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Company	Price	DCF Value Per Share	Pricing Multiple	Relative Regression Price Per Share	Market Regression Price Per Share	Recommendation
LYFT	\$10.89	\$8.04	EV/SALES	\$15.73	\$30.84	SELL
DASH	\$62.37	\$36.97	EV/SALES	\$23.21	\$57.35	SELL
DUOL	\$120.61	\$44.91	EV/SALES	\$19.96	\$27.14	SELL
ISRG	\$304.88	\$235.89	EV/EBITDA	\$213.31	\$140.90	SELL
RACE	€269.50	€105.60	EV/EBITDA	€ 72.19	€ 141.49	SELL

Lyft (NASDAQ: LYFT)
Valuation Performed by Harrison Wang

1. Company Overview: The Fallen Ride-Sharing Giant

Lyft is a software company founded in 2012 with operations in the U.S. and select Canadian cities. It went public through an IPO in 2019 and is the second biggest ride-sharing platform in the U.S. after Uber. The company offers ride-sharing services for cars, scooters, and bicycles through its mobile app. Although it participates in the transportation industry, Lyft brands itself as a technology company that serves to connect riders and drivers. Lyft calculates fares in real-time using a dynamic pricing model based on the supply and demand of vehicles at the time a ride is hailed. Lyft receives a commission from each ride booking.

Lyft has suffered heavy operating losses for the past three years due to the effects of the COVID-19 pandemic and a slowdown in the demand for ride-sharing services. The company has seen its highest ridership levels in the three years at 20.4 million riders in Q4 2022. This demonstrates a road to recovery from the pandemic that will continue to gradually increase Lyft's revenues and cash flows. The recent layoffs (~26% of its workforce) signal that Lyft's path to profitability is shifting heavily towards reducing operating costs, which will improve their margins in the coming years. Yet, Lyft is drastically losing market share to Uber, which not only has a stronghold over the ride-sharing industry (~74%) but has also successfully expanded into massive verticals such as food/grocery delivery and freight shipping. Meanwhile, Lyft operates almost purely in ride-sharing. Uber has also made more steps towards international expansion, while Lyft only retains a presence in North America. Lyft has recently made aggressive attempts to price-match Uber, which sets up a more competitive environment where both firms must differentiate themselves to consumers on the basis of brand name, services, and reliability. Thus, Lyft is exposed to the risk of changing consumer attitudes if its management remains hesitant with regards to growth and diversification. The main question is whether Lyft can still catch up to Uber and reclaim the market share that it lost, or if it is simply a losing battle.

2. DCF Valuation

	<i>The Assumptions</i>				
	<i>Base year</i>	<i>Next year</i>	<i>Years 2-5</i>	<i>Years 6-10</i>	<i>After year 10</i>
Revenues (a)	\$4,095,135.00	20.0%	12.50%	→	3.33%
Operating margin (b)	-41.78%	-25.0%	→		10.00%
Tax rate	25.00%		25.00%	→	25.00%
Reinvestment (c)		2.00	3.50	5.00	27.78%
Return on capital	-147.12%	Marginal ROIC =	155.43%		12.00%
Cost of capital (d)			12.45%	→	8.63%

- **Revenues:** I expect a recovery in revenues from low pandemic demand levels as more people travel, go out for leisure, or commute to their offices. Pricing competitively with Uber can also result in increased transaction volume, further bolstering Lyft's revenues. I predict that Lyft will expand into new businesses, which would increase revenues as well.
- **Operating Margin:** I expect operating margins to improve, aided by reducing operating costs (namely wages) and achieving scale through higher ridership. The industry average operating margin for software companies is 21.81% as of 1/1/2023 due to fairly low

overhead overall. However, I am targeting a margin of 10% for Lyft because of the immense SG&A costs associated with acquiring new drivers/riders and maintaining current ones. Incentivizing users is where Lyft must focus to play catch up with Uber.

- **Tax Rate:** Since Lyft is a money-losing company, I expect that its effective tax rate will adjust to the U.S. marginal tax rate of 25% once the firm improves its margins and starts making taxable income several years down the line.
- **Sales-to-Capital Ratio / Reinvestment:** I expect Lyft's recent performances and slipping market share to encourage management to invest more heavily in growth over the short-term in new services (food delivery, freight, car rentals, etc.), updated software, and partnerships/acquisitions to bolster their business lines. But at a certain point in the future, their growth ambitions will taper off as they reclaim market share; they will reinvest less as the company matures.
- **Return on Capital:** I estimate that the return on capital will increase as Lyft emerges from its current money-losing condition and invests heavily over the next few years to expand its technological capabilities, networks, and services offered.
- **Cost of Capital:** As Lyft becomes more profitable and less risky, I expect the cost of capital to eventually converge to the industry average cost of capital by year 10.
- **Beta:** I estimated that the beta will be the same as the industry average for software.
- **Risk-Free Rate:** I used the 10-year treasury bond yield as of the date of the valuation.

The Cash Flows						
	Revenues	Operating Margin	EBIT	EBIT (1-t)	Reinvestment	FCFF
1	\$4,914,162.00	-25.00%	-\$1,228,540.50	-\$1,228,540.50	\$409,513.50	-\$1,638,054.00
2	\$5,528,432.25	-15.00%	-\$829,264.84	-\$829,264.84	\$175,505.79	-\$1,004,770.62
3	\$6,219,486.28	-10.00%	-\$621,948.63	-\$621,948.63	\$197,444.01	-\$819,392.64
4	\$6,996,922.07	-5.00%	-\$349,846.10	-\$349,846.10	\$222,124.51	-\$571,970.61
5	\$7,871,537.32	0.00%	\$0.00	\$0.00	\$174,923.05	-\$174,923.05
6	\$8,711,178.47	2.60%	\$226,723.51	\$226,723.51	\$167,928.23	\$58,795.28
7	\$9,480,689.13	10.00%	\$948,068.91	\$948,068.91	\$153,902.13	\$794,166.78
8	\$10,144,375.29	10.00%	\$1,014,437.53	\$1,014,437.53	\$132,737.23	\$881,700.30
9	\$10,668,555.45	10.00%	\$1,066,855.55	\$1,066,855.55	\$104,836.03	\$962,019.51
10	\$11,024,245.09	10.00%	\$1,102,424.51	\$1,102,424.51	\$71,137.93	\$1,031,286.58
Terminal year	\$11,391,793.42	10.00%	\$1,139,179.34	\$854,384.51	\$237,376.50	\$617,008.01
The Value						
Terminal value			\$11,641,660.59			
PV(Terminal value)			\$3,992,219.03			
PV (CF over next 10 years)			-\$1,825,406.45			
Value of operating assets =			\$2,166,812.58			
Adjustment for distress			\$0.00		Probability of failure = 0.00%	
- Debt & Minority Interests			\$803,353.37			
+ Cash & Other Non-operating assets			\$1,796,792.00			
Value of equity			\$3,160,251.21			
- Value of equity options			\$6,527.48			
Number of shares			392,470.32			
Value per share			\$8.04		Stock was trading at = \$10.89	

3. Relative Valuation

Subjective Analysis: EV/Sales

Regression Analysis: EV/Sales vs. 2-Year Revenue Growth & Net Income Margin

Comparable Firms: Using CapitalIQ, I chose 19 comparable North American companies with similar characteristics to Lyft. Since there are very few ride-sharing software companies, I had to consider the trade-off between a small group of firms that are just like Lyft (e.g. Uber) and a larger sample of firms that are similar in only some dimensions. I chose to go the latter route, so I also selected firms within the transportation-as-a-service industry (e.g. car rental agencies like

Hertz or Avis) or ride-sharing apps that focus on only one specific mode of transportation (e.g. Bird Global with electric scooters).

Regression Equation:

Regression Equation

$$\text{TEV/Total Revenues LTM - Latest} = 0.929 + 0.1413 \text{ Est. Annual Revenue Growth} - 2 + 1.428 \text{ LTM Net Income Margin \%}$$

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.929	0.348	2.67	0.032	
Est. Annual Revenue Growth - 2	0.1413	0.0265	5.33	0.001	1.56
LTM Net Income Margin %	1.428	0.567	2.52	0.040	1.56

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.770620	80.60%	75.05%	61.33%

Since Lyft is a money-losing company, I decided to plug the year 10 forecasted DCF values into the sector regression equation. This is because investors would want to buy Lyft for how much they will make in the future.

$$\begin{aligned} \text{EV/Sales} &= .929 + .1413(.0333) + 1.428(.1) = 1.077 \\ \text{EV year 10} &= 1.077 * 11,024,245.09 = 11,867,858.16 \\ \text{PV of EV} &= 11,867,858.16 / 1.0863^{10} = 5,186,414.62 \end{aligned}$$

$$\begin{aligned} \text{Value of common stock} &= \text{EV} + \text{Cash} - \text{Debt} - \text{Options} \\ &= 5,186,414.62 + 1,796,792 - 803,353.37 - 6527.48 \\ &= 6,173,325.77 \end{aligned}$$

$$\text{Implied Pricing per share} = 6,173,325.77 / 392,470.32 \text{ shares outstanding}$$

Implied Pricing per share = **\$15.73**

4. Market Valuation

Regression Equation: $\text{EV/Sales} = 2.32 + 2.60g + 10.60 \text{ Oper Margin} - 1.40 \text{ DFR} - 3.50 \text{ Tax rate}$

Pricing: I plugged year 10 values into the regression, like I did above in the relative valuation.

$$\text{EV/Sales} = 2.32 + 2.60(.0333) + 10.60(.1) - 1.40(.20) - 3.50(.25)$$

$$\text{EV/Sales} = 2.31$$

$$\text{Expected EV year 10} = 2.31 * 11,024,245.09 = 25,442,022.58$$

$$\text{PV of EV} = 25,442,022.58 / 1.0863^{10} = 11,118,695.54$$

Value of common stock = EV + Cash - Debt - Value of Equity Options

$$= 11,118,695.54 + 1,796,792 - 803,353.37 - 6527.48 = 12,105,606.69$$

Implied pricing per share = 12,105,606.69 / 392,470.32 shares outstanding

Implied Pricing per share = **\$30.84**

5. Final Analysis

Lyft's current share price is \$10.89, which is higher than the DCF value per share of \$8.02 by 35.4%. However, the current share price is lower than the relative valuation and market valuation implied pricing per share, which are \$15.73 and \$30.84 respectively. The ride-sharing software business is an incredibly small market with few comparable companies, so the pricing in that sector cannot be explained by the fundamentals available today. Therefore, the sector and market regressions provide imperfect pricing estimates. Based on the assumptions I made in my intrinsic valuation, I believe Lyft is currently overvalued and I recommend to **SELL**.

DoorDash Inc. (NYSE: DASH)
Valuation Performed by James Luo

1. Company Overview: Too Much Faith in Food Delivery

DoorDash is a technology company that connects users with local restaurants and businesses through an on-demand delivery app. However, they have never achieved profitability in their 10 years of existence and it faces intense competition in the coming future. It will try to make investments and acquisitions that will help them keep their competitive edge with their 59% market share and expand further, but this is costly and slows their path to profitability even further.

Over time, margins will improve through actions such as increased penetration of their DashPass and expanded non-restaurant categories. DoorDash has also been trying to trim their operating expenses recently with layoffs of 1,250 corporate employees (6% of their employees) and it must keep a watch on their expenses if they want to ever achieve profitability. DoorDash has achieved recent success in adding new categories and in international markets, but will also have to deal with inflationary pressures impacting consumer spending. To summarize, DoorDash will have margins improve over time due to increased penetration of their DashPass, expanded categories, and through trimming their operational expenses but still has to face the hardship of turning a profit.

2. DCF Valuation

The Assumptions						
	Base year	Next year	Years 2-5	Years 6-10	After year 10	Link to story
Revenues (a)	\$6,583.00	30.0%	18.00%		3.33%	
Operating margin (b)	-9.55%	-10.0%			13.00%	
Tax rate	2.00%		2.00%		25.00%	
Reinvestment (c)		1.70	2.30	3.24	27.78%	
Return on capital	-14.44%	Marginal ROIC =	55.56%		12.00%	
Cost of capital (d)			11.16%		8.63%	
The Cash Flows						
	Revenues	Operating Margin	EBIT	EBIT (1-t)	Reinvestment	FCFF
1	\$8,557.90	-10.00%	-\$855.79	-\$855.79	\$1,161.71	-\$2,017.50
2	\$10,098.32	-3.43%	-\$346.23	-\$346.23	\$669.75	-\$1,015.98
3	\$11,916.02	-0.14%	-\$17.02	-\$17.02	\$790.30	-\$807.33
4	\$14,060.90	3.14%	\$441.91	\$441.91	\$932.56	-\$490.64
5	\$16,591.87	6.43%	\$1,066.62	\$1,066.62	\$781.16	\$285.46
6	\$19,091.73	9.71%	\$1,854.63	\$1,756.67	\$771.56	\$985.11
7	\$21,408.24	13.00%	\$2,783.07	\$2,471.37	\$714.97	\$1,756.39
8	\$23,377.89	13.00%	\$3,039.13	\$2,558.94	\$607.91	\$1,951.03
9	\$24,843.03	13.00%	\$3,229.59	\$2,570.76	\$452.20	\$2,118.55
10	\$25,671.29	13.00%	\$3,337.27	\$2,502.95	\$255.64	\$2,247.31
Terminal year	\$26,527.17	13.00%	\$3,448.53	\$2,586.40	\$718.59	\$1,867.81
The Value						
Terminal value			\$35,241.73			
PV(Terminal value)			\$13,107.97			
PV (CF over next 10 years)			\$547.85			
Value of operating assets =			\$13,655.82			
Adjustment for distress			\$0.00		Probability of failure = 0.00%	
- Debt & Minority Interests			\$313.20			
+ Cash & Other Non-operating assets			\$3,757.00			
Value of equity			\$17,099.62			
- Value of equity options			\$957.25			
Number of shares			436.60			
Value per share			\$36.97		Stock was trading at = \$62.37	

- **Revenue:** DoorDash has been trying to expand into new segments with non-restaurant categories and a premium subscription of their DashPass, but as more competitors enter the market, I believe that revenue growth will slow.
- **Operating Margin:** I expect that over time margins will improve through economies of scale and successful acquisition integration to 13%. DoorDash is still currently growing and margins will gradually increase when they slow their focus on growth and turn to focus on their user base. The increased penetration of the DashPass and expanded sale of non-restaurant categories will improve sales with premium DashPass users growing to 32 million users (up 30%) in the past year. DoorDash themselves have been attempting to reduce operating expenses such as wages and with their subscription model and competitive edge in market share, I expect their revenues to stabilize and expenses to decrease with greater efficiency. The industry average operating margin for software companies is 21.81% as of January 2023, but even with their efforts, DoorDash faces immense operating costs to maintain their market share and keep their competitive edge.
- **Tax Rate:** I expect that DoorDash will reach the Global/US marginal tax rate over time.
- **Reinvestment:** I expect that DoorDash will maintain their reinvestment at their current level in an attempt to keep their competitive edge and their market share.
- **Return on Capital:** I believe that the return on capital will increase over time as DoorDash improves their efforts to reduce their operating expenses and leverage their competitive edges of market share.
- **Cost of Capital:** I expect that the cost of capital will be close to the median of companies in this space.

With all these assumptions, I arrived at a value of \$36.97 which is 40.72% overvalued relative to the current stock price of \$62.37.

3. Relative Valuation

Subjective Analysis: EV/Sales

Regression Analysis: Ev/Sales vs LTM EBIT Margin & Annual Revenue Growth

Comparable Companies: From my market research, I found a sample of 17 public firms operating in the US, Canada, Europe, or China. Because there are very few public food delivery platform firms, I had to balance the trade off of very few firms similar to DoorDash vs a large sample of firms similar in some dimensions. I made the decision to include firms that deliver their own food to its customers to my sample as well.

Regression:

Regression Equation

EV/Sales = 0.661 + 2.94 LTM EBIT Margin % + 0.1645 Est. Annual Revenue Growth

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
1.42096	72.41%	66.89%	32.62%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.661	0.571	1.16	0.274	
LTM EBIT Margin %	2.94	1.72	1.71	0.119	1.48
Est. Annual Revenue Growth - 2	0.1645	0.0333	4.94	0.001	1.48

The p-value for the t-statistics for Estimated Annual Revenue Growth in next 2 years is very low and indicates a statistically significant relationship, and the p-value for the LTM EBIT Margin % is somewhat high, but can be said to be at least marginally significant. Also, running a best subset model did indicate the two-predicting variable model to be the most appropriate here, as I was choosing from 6 possible predicting variables (including but not limited to DFR, Tax Rate, and Beta) The R² of the regression model is decently high.

Because DoorDash is a money-losing firm, I used the 10 year forecasted DCF values into the sector regression equation. This is because investors are not buying DoorDash for the money they made last year, but instead their beliefs in how much DoorDash will make in the future.

$$\begin{aligned} \text{EV/Sales} &= .661 + 2.94(.13) + .1645(.0333) = 1.048 \\ \text{EV year 10} &= 1.048 \times 17,099.62 = 17,920.59 \\ \text{PV of EV} &= 26,903.51 \div 1.0863^{10} = 7,831.59 \\ \text{Value of Common Stock} &= \text{EV} + \text{Cash} - \text{Debt} - \text{Options} \\ &= 7,831.59 + 3,757.00 - 313.20 - 957.25 = 10,136.14 \\ \text{Implied Pricing Per Share} &= 10,136.14 \div 436.6 = \mathbf{\$23.21} \end{aligned}$$

4. Market Valuation

Regression Equation: $\text{EV/Sales} = 2.32 + 2.60 g + 10.60 \text{ Oper Margin} - 1.40 \text{ DFR} - 3.50 \text{ Tax rate}$

Parameters Used:

g = Expected growth rate in revenues for next 5 years
Operating Margin: Pre-tax Operating Income/ Sales
DFR: Total Debt/(Total Debt + Market value of equity)
Tax rate: Taxes paid/ Taxable Income

Pricing: Like the sector regression, I used the forecasted year 10 DCF values for the valuation.

$$\begin{aligned} \text{EV/Sales} &= 2.32 + 2.60 (.0333) + 10.60 (.13) - 1.40 (.019) - 3.5(.25) = 2.88 \\ \text{Expected EV year 10} &= 2.88 \times 17,920.59 = 51,611.29 \\ \text{PV of EV} &= 51,611.29 \div 1.0863^{10} = 22,555.21 \\ \text{Value of Common Stock} &= \text{EV} + \text{Cash} - \text{Debt} - \text{Options} \\ &= 22,555.21 + 3,757.00 - 313.20 - 957.25 = 25,041.76 \\ \text{Implied Pricing Per Share} &= 25,041.76 \div 436.6 = \mathbf{\$57.35} \end{aligned}$$

5. Final Analysis

The current price of DoorDash is \$62.37 which is higher than the DCF valuation of \$36.97 per share, relative valuation of \$23.21 per share, and the market valuation implied pricing per share of \$57.35. All of the values are lower than the current price per share of DoorDash and thus I would recommend to **SELL** DoorDash.

Duolingo (NASDAQ: DUOL)
Valuation Performed by Lucy Yao

1. Company Overview: Too Much To Learn, Too Much To Lose

Duolingo is an innovative market leader in the education technology space though it has yet to achieve profitability. The company is based in Pittsburgh, PA unlike their Bay Area-based peers and they pride themselves in operating through extremely lean teams. Their primary streams of revenue comes from their premium subscription model Duolingo Plus, advertising for freemium users, in-app purchases (IAPs), and Duolingo English Test officially recognized by 3,800+ universities including Yale and Duke. Duolingo for Schools also partners them with K-12 schools to provide app access for free. The Duolingo platform offers lessons for 40+ languages, using A/B testing and novel AI techniques to personalize student learning experiences. It accommodates 60.7 monthly active users (MAUs), 7.8% of which are premium subscribers. Duolingo also continues to expand to other areas of education and access as seen in the recent rollout of Duolingo ABC to teach early literacy skills and Duolingo Math. While new products give opportunity for revenue and growth, not focusing on their subscription model to generate revenue hinders their path to profitability anytime soon. Duolingo also faces risks in slowdown of premium subscriptions as most interested users would have already subscribed, especially following recent criticism on their overhauled user interface and the rise in artificial intelligence as competitors. Though, committed members, newly acquired international users, and university partnerships could provide a steady stream of long-term revenue.

2. DCF Valuation

The Assumptions						
	Base year	Next year	Years 2-5	Years 6-10	After year 10	Link to story
Revenues (a)	\$369,495.00	40.0%	18.00%		3.33%	
Operating margin (b)	3.07%	3.5%			14.00%	
Tax rate	21.00%		21.00%		25.00%	
Reinvestment (c)		2.80	2.80	4.00	33.34%	
Return on capital	6.01%	Marginal ROIC =		47.58%	10.00%	
Cost of capital (d)			7.94%		8.63%	
The Cash Flows						
	Revenues	Operating Margin	EBIT	EBIT (1-t)	Reinvestment	FCFF
1	\$517,293.00	3.50%	\$18,105.26	\$18,105.26	\$33,254.55	-\$15,149.30
2	\$610,405.74	6.50%	\$39,676.37	\$36,543.04	\$39,240.37	-\$2,697.33
3	\$720,278.77	8.00%	\$57,622.30	\$45,521.62	\$46,303.64	-\$782.02
4	\$849,928.95	9.50%	\$80,743.25	\$63,787.17	\$54,638.29	\$9,148.88
5	\$1,002,916.16	11.00%	\$110,320.78	\$87,153.41	\$37,776.84	\$49,376.57
6	\$1,154,023.54	12.50%	\$144,252.94	\$112,805.80	\$35,006.15	\$77,799.65
7	\$1,294,048.14	14.00%	\$181,166.74	\$140,223.06	\$29,764.40	\$110,458.65
8	\$1,413,105.74	14.00%	\$197,834.80	\$151,541.46	\$22,140.54	\$129,400.92
9	\$1,501,667.90	14.00%	\$210,233.51	\$159,357.00	\$12,516.40	\$146,840.60
10	\$1,551,733.51	14.00%	\$217,242.69	\$162,932.02	\$12,933.70	\$149,998.32
Terminal year	\$1,603,468.31	14.00%	\$224,485.56	\$168,364.17	\$56,132.62	\$112,231.56
The Value						
Terminal value			\$2,117,576.55			
PV(Terminal value)			\$967,278.68			
PV (CF over next 10 years)			\$348,067.50			
Value of operating assets =			\$1,315,346.18			
Adjustment for distress			\$85,497.50		Probability of failure = 10.00%	
- Debt & Minority Interests			\$12,769.27			
+ Cash & Other Non-operating assets			\$608,180.00			
Value of equity			\$1,825,259.40			
- Value of equity options			\$482.25			
Number of shares			40,635.92			
Value per share			\$44.91		Stock was trading at = \$120.61	

- **Revenue:** Duolingo will continue to experience revenue growth as their number of active users grows. Between 2021 and 2022, MAUs increased from 42.4 to 60.7 million; this growth should continue as Duolingo increases in global product offerings, university partnerships, and international marketing.
- **Operating Margin:** I predict margins will eventually grow from 3.5% to a relatively high 14%. I believe margins will improve as Duolingo slows their rapid expansion of products and focuses on their current user base in their subscription-based business model. I predict it will incur less R&D and marketing cost as freemium users convert to premium as it is less costly to retain university partnerships and premium subscribers than to attract new customers. Moreover, their subscription model has lower overhead costs as it is entirely virtual. Between 2021 and 2022, Duolingo's ratio of premium users to all users increased from 6.2% to 7.8% where continued growth is expected in the future. With their largely established subscription model and first mover status, they will gain a stable source of revenue without much development costs as their platform becomes more established and runs more efficiently.
- **Tax Rate:** For my estimation, I decided to use the effective tax rate of 21% for the current year that will eventually converge to the US marginal tax rate of 25%.
- **Reinvestment:** As a high-growth company, Duolingo has a lot of reinvestment to develop new products such as new courses with AI personalization and accommodation of more international users. I predict it will stabilize to a lower rate as they refine their technology and learning materials.
- **Return on Capital:** The current ROC is very high as Duolingo uses their capital efficiently to attract new users and keep existing users committed. Strong competitive edges exist in their widespread university partnerships, revolutionary personalized language learning curriculum using ML/AI technology, and recognizable brand name made stronger by their viral Gen-Z marketing campaigns. I predict it will decrease over time as the benefits of early investments will decrease as new competitors crop up.
- **Cost of Capital:** Cost of capital does not change much as Duolingo does not borrow much capital, as seen in their lack of debt. I predict it will eventually reach the industry cost of capital from 7.94% to 8.63% which is slightly higher and riskier.

3. Relative Valuation

My regression predicts EV/Sales given Estimated Annual Revenue Growth % for 2 Years and Net Income Margin %. I used a sample size of 20 North American companies in the education technology segment with similar subscription business models and MAUs. This model has a relatively high R² where the p-values for the overall regression and each predicting variable is

Regression Equation

$$EV/Sales = 0.898 + 0.04973 \text{ Est. Annual Revenue Growth} - 2 + 2.62 \text{ LTM Net Income Margin \%}$$

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	0.898	0.253	3.55	0.003	
Est. Annual Revenue Growth - 2	0.04973	0.00684	7.27	0.000	1.04
LTM Net Income Margin %	2.62	1.24	2.12	0.052	1.04

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
0.935245	82.61%	80.12%	42.00%

statistically significant. Note that the p-value for the Net Income Margin % is 0.052, which is slightly higher than the commonly-used standard 0.05, but it can be reasonably interpreted as statistically significant.

As Duolingo is a money losing company, I predict the EV/Sales multiple using forecasted metrics and convert values back to their present value.

$$\begin{aligned}\text{Net Income Margin \%} &= \text{EBIT}(1-t) \text{ in Year 10} / \text{Revenue in Year 10} \\ &= \$162,932.02 / \$1,551,733.51 = 10.50\%\end{aligned}$$

$$\begin{aligned}\text{EV/Sales} &= 0.898 + 4.973 * \text{Est. Annual Rev. Growth for 2 Years} + 2.62 * \text{Net Income Margin \%} \\ &= 0.898 + 4.973 * (3.33\%) + 2.62 * (10.50\%) = 1.3387009\end{aligned}$$

$$\text{Expected EV in Year 10} = 1.3387009 * \$369,495.00 = \$494,643.289$$

$$\text{PV of EV} = \$494,643.289 \div 1.0863^{10} = \$216,169.4541$$

Value of Common Stock

$$\begin{aligned}&= \text{EV} - \text{Debt} - \text{Minority Interests} + \text{Cash} + \text{Non-operating assets} - \text{Value of Options} \\ &= \$216,169.4541 - \$12,769.27 - 0 + \$608,180.00 + 0 - \$482.25 = \$811,097.9341\end{aligned}$$

$$\text{Implied Price Per Share} = \$811,097.9341 \div 40,635.92 \text{ shares} = \mathbf{\$19.96}$$

4. Market Valuation

$$\begin{aligned}\text{DFR} &= \text{Total Debt} / (\text{Total Debt} + \text{Market value of equity}) \\ &= \$12,769.27 / (\$12,769.27 + \$1,825,259.40) = 0.006947264\end{aligned}$$

$$\begin{aligned}\text{EV/Sales} &= 2.32 + 2.60 * g + 10.60 * \text{Operating Margin} - 1.40 * \text{DFR} - 3.50 * \text{Tax Rate} \\ &= 2.32 + 2.60 * (3.33\%) + 10.60 * (14\%) - 1.40 * (0.006947264) - 3.50 * (21\%) \\ &= 3.14585383\end{aligned}$$

$$\text{Expected EV in year 10} = 3.14585383 * \$369,495.00 = \$1,162,377.261$$

$$\text{PV of EV} = \$1,162,377.261 \div 1.0863^{10} = \$507,983.1538$$

Value of Common Stock

$$\begin{aligned}&= \text{EV} - \text{Debt} - \text{Minority Interests} + \text{Cash} + \text{Non-operating assets} - \text{Value of Options} \\ &= \$507,983.1538 - \$12,769.27 - 0 + \$608,180.00 + 0 - \$482.25 = \$1,102,911.634\end{aligned}$$

$$\text{Implied Price Per Share} = \$1,102,911.634 \div 40,635.92 \text{ shares} = \mathbf{\$27.14}$$

5. Final Analysis

Despite optimism for revenue growth, I don't expect Duolingo to reach profitability anytime soon. The current share price is \$120.61, while my DCF Valuation, Relative Valuation, and Market Regression all estimate much lower values of \$44.91, \$19.96, and \$27.14 respectively. Based on my assumptions, I recommend to **SELL** Duolingo stock because it is currently extremely overvalued.

Intuitive Surgical (NASDAQ: ISRG)
Valuation Performed by Peter Shi

1. Company Overview: Your only Option for Minimally Invasive Surgery

Intuitive Surgical is a US-based MedTech company and a market leader in robotic systems for minimally invasive surgeries. The company has a simple business model of selling basically just one product: the *da Vinci* robotic systems, and also gets revenue from the maintenance, fixing and sale of accessories for these *da Vinci* sold. The company is a dominant leader, if not a monopoly in the minimally invasive robotic systems space, and has seen rapid growth in the past ten years (tripling revenue). This growth is propelled by hospitals around the world's increasing interest in performing minimally invasive surgeries. The growth slowed down in 2020 as hospitals were distracted by the pandemic, recovered a lot in 2021 (about 30%) when quarantine requirements eased in the US and other countries, then dropped again in 2022 with China's lockdown and omicron (but still 8%).

2. DCF Valuation

The Assumptions					
	<i>Base year</i>	<i>Next year</i>	<i>Years 2-5</i>	<i>Years 6-10</i>	<i>After year 10</i>
Revenues (a)	\$6,266.60	32.0%	22.00%		3.30%
Operating margin (b)	29.62%	30.0%			40.00%
Tax rate	16.30%		16.30%		16.30%
Reinvestment (c)		7.00	6.00	4.00	38.37%
Return on capital	25.95%	Marginal ROIC =		196.04%	8.60%
Cost of capital (d)			10.34%		8.60%

Terminal value	\$122,253.01
PV(Terminal value)	\$47,914.43
PV (CF over next 10 years)	\$30,334.93
Value of operating assets =	\$78,249.36
Adjustment for distress	\$0.00
- Debt & Minority Interests	\$161.17
+ Cash & Other Non-operating assets	\$6,741.50
Value of equity	\$84,829.69
- Value of equity options	\$2,174.29
Number of shares	350.40
Value per share	\$235.89

The Cash Flows						
	<i>Revenues</i>	<i>Operating Margin</i>	<i>EBIT</i>	<i>EBIT (1-t)</i>	<i>Reinvestment</i>	<i>FCFF</i>
1	\$8,271.91	30.00%	\$2,481.57	\$2,077.08	\$286.47	\$1,790.60
2	\$10,091.73	32.50%	\$3,279.81	\$2,745.20	\$303.30	\$2,441.90
3	\$12,311.91	33.75%	\$4,155.27	\$3,477.96	\$370.03	\$3,107.93
4	\$15,020.53	35.00%	\$5,257.19	\$4,400.27	\$451.44	\$3,948.83
5	\$18,325.05	36.25%	\$6,642.83	\$5,560.05	\$826.13	\$4,733.92
6	\$21,671.21	37.50%	\$8,126.70	\$6,802.05	\$836.54	\$5,965.51
7	\$24,817.87	38.75%	\$9,616.92	\$8,049.36	\$786.66	\$7,262.70
8	\$27,493.23	40.00%	\$10,997.29	\$9,204.73	\$668.84	\$8,535.89
9	\$29,428.76	40.00%	\$11,771.50	\$9,852.75	\$483.88	\$9,368.87
10	\$30,399.90	40.00%	\$12,159.96	\$10,177.89	\$242.79	\$9,935.10
Terminal year	\$31,403.10	40.00%	\$12,561.24	\$10,513.76	\$4,034.35	\$6,479.41

- **Revenue:**

I assume very high growth in the next year as hospitals are no longer distracted from COVID and can re-focus on investing in minimally invasive surgeries, and Intuitive Surgical is almost the only company they can turn to. The growth will slow down a bit after the next year since the "big recovery" from COVID fades, but will still be very high as the trend of hospitals seeking to provide minimally invasive surgeries to patients continues.

- **Operating Margin:**

The company's operating margin is much higher than industry average, justified by its almost monopoly-like position in the minimally invasive surgery robotic systems space. With rapid growth as projected within our projected period we assume this company will also be able to enjoy some margin expansion.

- **Tax Rate:**

I assume that the company will be able to continue to pay below its marginal tax rate because of R&D tax credits, among other factors.

- **Beta:**

The beta is estimated using the industry average of the sector

- **Risk Free Rate:**

I just used the 10-year treasury bond rate as of the date of my valuation of 3.30%.

- **Reinvestment:**

While the company will not have to invest too much in the near future for its growth with hospitals coming to them for more of their robotic systems post-pandemic, further into the future it will have to increase its reinvestment to support growth

- **Return on Capital:**

The company has strong competitive edges, along with its dominant position in its respective space that should yield high return within the projection period

- **Cost of Capital:**

The Cost of Capital is estimated to be close to industry median

Given all the assumptions above, I end up with a value of \$235.89 per share, lower than the current stock price of \$304.88.

3. Relative Valuation

Subject Analysis: EV/EBITDA

Regression Analysis: EV/EBITDA vs. NTM EPS Growth

Comparable Companies: from Capital IQ I got 21 companies in the MedTech and hospital equipment industry. All companies are based in the US.

Regression Equation:

$$\text{EV/EBITDA} = 10.33 + 154.8 \text{ NTM EPS Growth}$$

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	10.33	3.81	2.71	0.014	
NTM EPS Growth	154.8	15.4	10.03	0.000	1.00

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
14.1373	84.12%	83.29%	78.84%

This regression model has a rather high R² value, while the p-values for the t-statistics of both the intercept and the slope coefficient of NTM EPS Growth are statistically significant.

Based on the equation, the pricing per share is computed below:

$$\text{EV/EBITDA} = 10.33 + 154.8 * (0.1666) = 36.12$$

$$\text{EV} = 36.12 * 1947.4 = \$70339.46 \text{ million}$$

$$\text{Equity Value} = 70339.46 - 90.47 - 70.7 + 6741.5 - 2174.29 = \$74745.50 \text{ million}$$

$$\text{Pricing per Share} = 74745.50 / 350.4 = \underline{\underline{\$213.31}} \text{ per Share}$$

4. Market Valuation

Regression Equation: $\text{EV/EBITDA} = 23.93 + 25.40 g - 8.20 \text{ DFR} - 34.40 \text{ Tax Rate}$

Growth (g) (Expected Growth Rate in Revenue for the Next 5 Years based on Analyst Estimates): 14.4%

DFR: 0.846%

Tax Rate: 16.30%

Implied Share Price = **\$140.90**

5. Final Analysis

The current share price of Intuitive Surgical is \$304.88. The DCF Valuation, Relative Valuation, and Market Valuation all gives me value per share well below the market price. I think the market may not have fully realized the company's need for reinvestment to grow in the longer term, and extra premium may have been placed on the company for its monopoly-like position, along with its very healthy cash position from its debt-free strategy.

As such, I recommend **SELL** Intuitive Surgical.

Ferrari N.V. (NYSE: RACE)
Valuation Performed by Lisa Wang

1. Company Overview: The Luxury Rides on

Ferrari N.V. is among the world's most famous designers and manufacturers of luxurious sports cars, headquartered in Italy. The company's target clients are the high-net-worth individuals around the world from Switzerland and France to China and Japan. These client bases enable them to earn higher margins and profits than just the auto-making industry average. In 2022, the company saw some headwinds in its growth due to supply chain disruption and lockdowns from China (where even the rich were locked down and slowed in buying luxurious cars). While the recovery in 2023 from China and from COVID overall should boost growth in 2023, Ferrari's long-term exclusivity strategy will limit their growth going forward. The company also will have to reinvest a lot as is the norm in the luxury auto industry, and as the company must invest to develop Electric Vehicles (as now their cars still mostly rely on internal combustion engines) and perform better in Formula 1 competitions, as they have been performing poorly recently - doing well in these competitions has historically been a big part of their brand image.

2. DCF Valuation

	Base year	Next year	Years 2-5	Years 6-10	After year 10
Revenues (a)	\$5,095,254.00	20.0%	5.00%		3.28%
Operating margin (b)	24.09%	26.0%			30.00%
Tax rate	20.20%		20.20%		24.00%
Reinvestment (c)		3.50	3.50	1.60	40.75%
Return on capital	24.32%	Marginal ROIC =	69.20%		8.05%
Cost of capital (d)			9.52%		8.05%

	The Cash Flows					FCFF
	Revenues	Operating Margin	EBIT	EBIT (1-t)	Reinvestment	
1	\$6,114,304.80	26.00%	\$1,589,719.25	\$1,268,595.96	\$87,347.21	\$1,181,248.75
2	\$6,420,020.04	27.14%	\$1,742,576.87	\$1,390,576.34	\$91,714.57	\$1,298,861.77
3	\$6,741,021.04	27.71%	\$1,868,225.83	\$1,490,844.21	\$96,300.30	\$1,394,543.91
4	\$7,078,072.09	28.29%	\$2,002,083.25	\$1,597,662.43	\$101,115.32	\$1,496,547.12
5	\$7,431,975.70	28.86%	\$2,144,655.84	\$1,711,435.36	\$216,270.49	\$1,495,164.87
6	\$7,778,008.49	29.43%	\$2,288,956.78	\$1,809,191.44	\$209,617.33	\$1,599,574.11
7	\$8,113,396.21	30.00%	\$2,434,018.86	\$1,905,349.97	\$201,212.23	\$1,704,137.74
8	\$8,435,335.78	30.00%	\$2,530,600.73	\$1,961,721.69	\$191,060.36	\$1,770,661.33
9	\$8,741,032.34	30.00%	\$2,622,309.70	\$2,012,884.93	\$179,191.16	\$1,833,693.77
10	\$9,027,738.20	30.00%	\$2,708,321.46	\$2,058,324.31	\$185,068.63	\$1,873,255.68
Terminal year	\$9,323,848.02	30.00%	\$2,797,154.41	\$2,125,837.35	\$866,179.69	\$1,259,657.66

Terminal value	\$26,407,917.37
PV(Terminal value)	\$11,072,556.04
PV (CF over next 10 years)	\$9,534,722.43
Value of operating assets =	\$20,607,278.47
Adjustment for distress	\$0.00
- Debt & Minority Interests	\$2,821,482.74
+ Cash & Other Non-operating assets	\$1,388,901.00
Value of equity	\$19,174,696.73
- Value of equity options	\$0.00
Number of shares	181,570.00
Value per share	\$105.60

- **Revenue:**

The company's 2023 Q1 Earnings call showed 20% revenue growth from Q1 2022 to Q1 2023, which is due to the recovery from 2022's omicron and China's Lockdown. I believe the 20% growth is reasonable as an annual growth rate for 2023. After next year I am starting with a low growth rate in single digits; this is because the company, after COVID, should return back to its low growth as a result of its long-term strategy of maintaining a lower supply relative to demand, maintaining its exclusive brand image and premium pricing.

- **Operating Margin:**

The company's Q1 earnings call mentioned that the management expected margins to improve from 24% to 26% next year. I believe this is a valid projection as many factors that hammered the company's margin in 2022 like the supply chain disruption and lockdown from China have faded away in 2023. Going forward, I expect the company's margins to increase slightly as the demand for Ferrari cars remains strong (orders lasting to 2025) and the company is expected to continue its exclusivity strategy.

- **Tax Rate:**

For tax rate I am just assuming the tax rate to converge to the marginal tax rate over time

- **Reinvestment:**

Generally, the luxury auto industry sees high reinvestments as it is the key to survival for these companies to release new models of cars from time to time. The reinvestment for Ferrari can be slightly lower to start off because they can get some growth from just the recovery from 2022 without increasing that much in reinvestment. However, the company later would have to really reinvest a lot, because first of all the company is (and has to be) transitioning to EV. The Q1 earnings call already shows that hybrid cars already contribute more than 20% of the company's revenue in 2022, up from essentially 0 pre-2020. However, the company is yet to release a pure-EV, and it will have to reinvest a lot to get there. Moreover, the strong demand for orders lasting to 2025 as I mentioned in the revenue section also means the company needs to reinvest to expand its productions. Plus, the company's recent losing-streak in F1 competitions also requires it to invest a lot in improving the performance of their products if they want to win back their previous glory in these competitions.

- **Return on Capital:**

The company has strong competitive edges in being perhaps the most well-known luxurious sports car brand, on top of its technological advancement. It should be noted that the return on capital should and can be much higher than industry averages given how Ferrari is targeting high net-worth individuals - these people are those whose purchases are not so much affected even in a recession or high-inflation environment.

- **Cost of Capital**

I estimate the Cost of Capital of Ferrari to be close to the industry median

Given all the assumptions above, I end up with a value of **€105.6** per share, lower than the current stock price of **€269.5**.

3. Relative Valuation

Subject Analysis: EV/EBITDA

Regression Analysis: EV/EBITDA vs. Estimated Annual Revenue Growth in the next 2 years (in percentage points) & 5-year Beta

Comparable Companies: From Capital IQ, I got 18 companies in the high-end auto manufacturing industry across the globe.

Regression Equation:

Regression Equation

TEV/EBITDA LTM - Latest = $-4.66 + 0.4187 \text{ Est. Annual Revenue Growth} - 2 + 9.51 \text{ 5 Year Beta}$

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-4.66	3.52	-1.32	0.218	
Est. Annual Revenue Growth - 2	0.4187	0.0690	6.07	0.000	2.15
5 Year Beta	9.51	2.09	4.55	0.001	2.15

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
3.41947	80.37%	76.01%	46.71%

$$\text{EV/EBITDA} = -4.66 + 0.4187 * 10.6 + 9.51 * 0.99 = 9.20$$

$$\text{EV} = 9.2 * 1581.5 = \text{€}14,538.92 \text{ million}$$

$$\text{Equity Value} = 14538.92 - 2811.85 - 9.63 + 1388.90 = \text{€}13106.34 \text{ million}$$

$$\text{Price per Share} = 13106.24 / 181.57 = \text{€}72.19 \text{ per share}$$

4. Market Valuation

Regression Equation: $\text{EV/EBITDA} = 19.78 + 8g - 9.9 \text{ DFR} - 13.60 \text{ Tax Rate}$

Growth (g) (Expected Growth Rate in Revenue for the Next 5 Years based on Analyst Estimates): 8.17%

$$\text{DFR: } 5.43\% = \text{Total Debt} / (\text{Total Debt} + \text{Market Equity}) = 2811.85 / (2811.85 + 48933.12)$$

Tax Rate: 20.20%

$$\text{EV/EBITDA} = 17.15$$

$$\text{EV} = 17.15 * 1581.5 = \text{€}27,122.73 \text{ million}$$

$$\text{Equity Value} = 27,122.73 - 2811.85 - 9.63 + 1388.90 = \text{€}25690.15 \text{ million}$$

$$\text{Implied share price} = 25690.15 / 181.57 = \text{€}141.49 \text{ per share}$$

5. Final Analysis

Overall, I see that my DCF Valuation, Relative Valuation, and Market Valuation produces the values of €105.6, €72.19, and €141.49 per share, respectively. As the current stock price is €269.5, all my valuation methods indicate that the stock of Ferrari is overvalued. Overall, I think that the market may be too optimistic about Ferrari, underestimating how much Ferrari will have to reinvest and how their exclusivity strategy will limit their annual revenue growth in the foreseeable future. I recommend to **SELL** Ferrari.