

ST Pharm

(237690 KQ)

CDMO business to grow alongside novel therapies

Buy
(Initiate)

TP: W120,000
Upside: 60.0%

Mirae Asset Securities Co., Ltd.
Mihwa Seo mihwa.seo@miraeasset.com

Company overview

CDMO specializing in oligonucleotides

- Established in 1983 as Samchully Pharmaceutical, ST Pharm became a subsidiary of Dong-A Socio Holdings in 2010.
- The company has built a track record in supplying active pharmaceutical ingredients (APIs) for therapeutics based on nucleotides.
- The company is working to secure core technologies related to the growing messenger RNA (mRNA) therapeutics market.

Investment points

Growth of the oligonucleotide (oligo) CDMO business

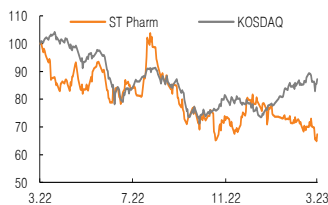
- We think the company could see increased orders from existing clients due to the commercialization of RNA therapies and/or the expansion of their indications.
- We see potential for cost improvements through enhanced production efficiency of APIs for RNA therapies.
- In 2022, oligo CDMO revenue grew 69.2% YoY.

Recommendation

Initiate coverage with Buy rating and TP of W120,000

- Our target price is based on an operating value of W2.3tr, which we derived using a DCF model.
- ST Pharm should see increased order wins from both new and existing customers amid the expansion of the RNA therapeutics market.
- OP margin could also pick up on improving production efficiency and stabilizing output.

Key data



Current price (3/17/23, W)	75,000	Market cap (Wbn)	1,411
OP (22, Wbn)	18	Shares outstanding (mn)	19
Consensus OP (22F, Wbn)	0	Free float (%)	52.1
EPS growth (22, %)	427.1	Foreign ownership (%)	1.2
P/E (22, x)	93.6	Beta (12M)	0.68
Market P/E (22, x)	11.6	52-week low (W)	72,200
KOSDAQ	797.39	52-week high (W)	115,500

Share performance

(%)	1M	6M	12M
Absolute	-6.0	-13.9	-32.6
Relative	-8.6	-16.8	-22.7

Earnings and valuation metrics

(Dec.)	2019	2020	2021	2022	2023F	2024F
Revenue (Wbn)	93	124	166	249	285	351
OP (Wbn)	-27	-19	6	18	31	62
OP margin (%)	-29.0	-15.3	3.6	7.2	10.9	17.7
NP (Wbn)	-19	-12	3	18	26	51
EPS (W)	-993	-651	177	936	1,369	2,690
ROE (%)	-5.9	-4.1	1.1	5.4	7.5	13.6
P/E (x)	-	-	784.2	93.6	54.8	27.9
P/B (x)	1.8	6.6	8.1	4.9	4.0	3.6
Div. yield (%)	0.0	0.0	0.4	0.6	0.7	0.7

Notes: Under individual K-IFRS; NP is attributable to owners of the parent
Source: Company data, Mirae Asset Securities Research estimates

I. RNA therapeutics nearing commercialization

1. RNA therapeutics market

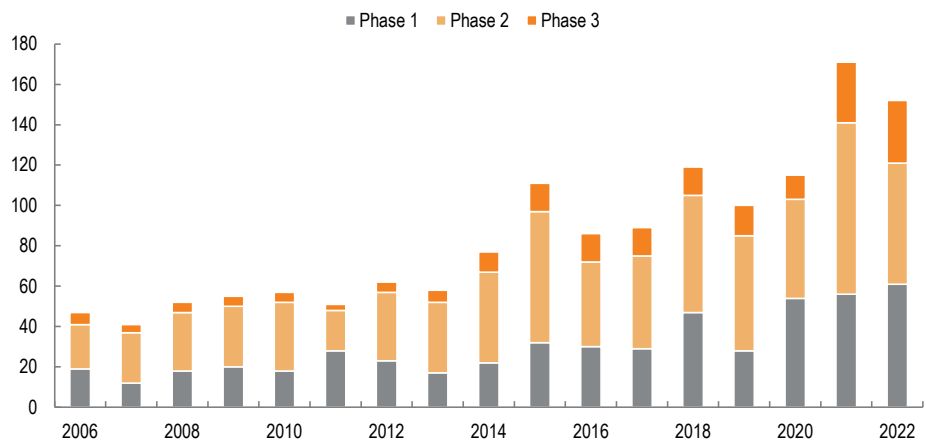
The introduction of mRNA vaccines to combat COVID-19 has spurred more research into RNA therapies. According to data from the American Society of Gene & Cell Therapy (ASGCT), there are currently 888 oligo therapies undergoing clinical trials. Market researcher Data Bridge expects the oligo therapeutics market to grow 13.8% CAGR from US\$20.7bn in 2022 to US\$51.4bn in 2029. This suggests that the market for relevant APIs could grow from US\$2.1bn in 2022 to US\$5.1bn in 2029, assuming the API market is roughly 10% of the oligo therapeutics market.

We forecast the oligo therapeutics market to reach US\$27.5bn by 2028; this figure represents the sum of our revenue forecasts for: 1) therapies commercially available as of 2023 (US\$17.4bn); and 2) therapies currently in phase 2 or 3 trials (US\$10.1bn). Based on market research data and our own estimates for the oligo therapeutics market, the oligo CDMO market size could range between US\$2.8bn and US\$5.1bn in 2028. Of note, Agilent Technologies projects the oligo CDMO market to reach US\$2.4bn (including CRISPR oligos, which account for 15%) in 2027.

Until 2020, there was little demand for CDMO services related to RNA therapeutics, as few RNA therapy candidates made it to the phase 2 stage, and most that did targeted rare diseases. However, expectations on the RNA therapy CDMO market have increased following the approvals of: 1) mRNA vaccines for COVID-19; and 2) Leqvio, which uses an RNAi mechanism to treat hyperlipidemia (one of the most common chronic diseases, affecting 16mn people in the US).

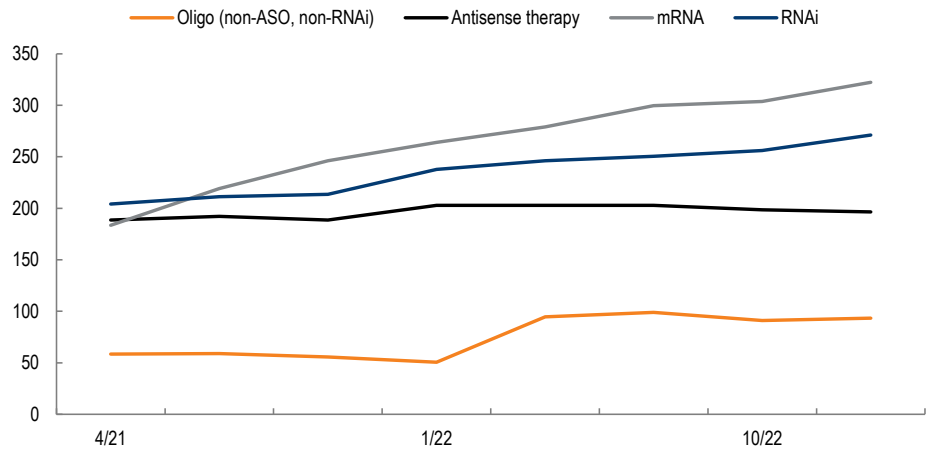
A number of therapies targeting diseases with larger patient populations are expected to emerge over the next five years, including cancer vaccines, mRNA-1010, RSV vaccines, mRNA-1647, and Tominersen (Huntington’s disease treatment). The rapidly evolving RNA therapy market is creating an opportunity for ST Pharm, which has years of experience supplying nucleotide APIs.

Figure 1. Annual no. of clinical trials initiated for oligo therapeutics by phase



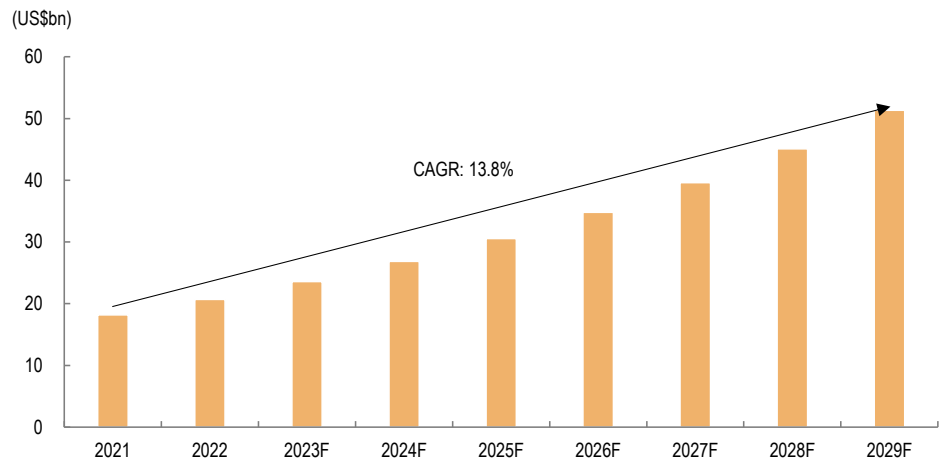
Source: GlobalData, Mirae Asset Securities Research

Figure 2. No. of clinical trials for oligo therapeutics by modality



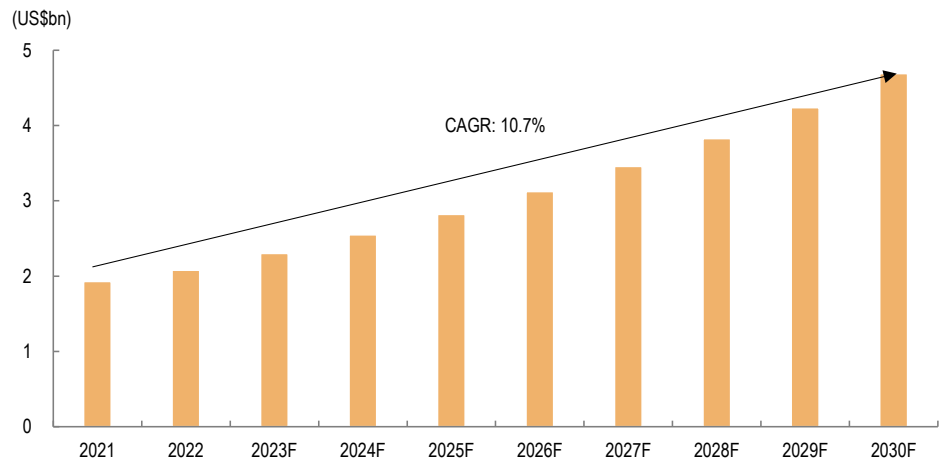
Source: ASGCT, Mirae Asset Securities Research

Figure 3. Global oligo therapeutics market outlook



Source: Data Bridge (2021), Mirae Asset Securities Research

Figure 4. Global oligo CDMO market outlook under conservative assumptions



Source: InsightAce Analytic (2022), Mirae Asset Securities Research

2. ST Pharm's core technologies

ST Pharm has secured patents for capping and lipid nanoparticle (LNP) technologies in order to prepare its CDMO business for mRNA therapies. The company has also enhanced productivity by applying an oligo manufacturing technology that uses dimers to improve purity.

ST Pharm should stand a better chance of winning orders once its capping and LNP technologies are clinically tested and proven. To that end, the company needs to either: 1) demonstrate the safety and superiority (or non-inferiority) of its technologies over existing technologies through its STP2104 clinical trials; or 2) prove the effectiveness of its technologies through application in clients' mRNA therapies currently in clinical trials. The phase 1 trial of STP2104, which is based on the company's SmartCap capping technology and Genevant Sciences' LNP technology, is expected to conclude in late March or early April.

1) Capping technology: SmartCap

Moderna's and Pfizer's COVID-19 mRNA vaccines use TriLink BioTechnologies' CleanCap technology, which requires less time and equipment and fewer manufacturing steps to elicit capped mRNA with 95% efficiency. Notably, however, CleanCap has only three cap analogs. By contrast, SmartCap—ST Pharm's proprietary capping technology developed jointly with Professor Lee Hyuk-jin of Ewha Womans University—has 30 cap analogs, offering a wider range for different investigational therapies. Because expression levels differ widely depending on the type of cell and RNA, a wider range of options can be more beneficial in terms of production efficiency. ST Pharm registered a domestic patent for the technology in Oct. 2020 and currently has an international patent pending.

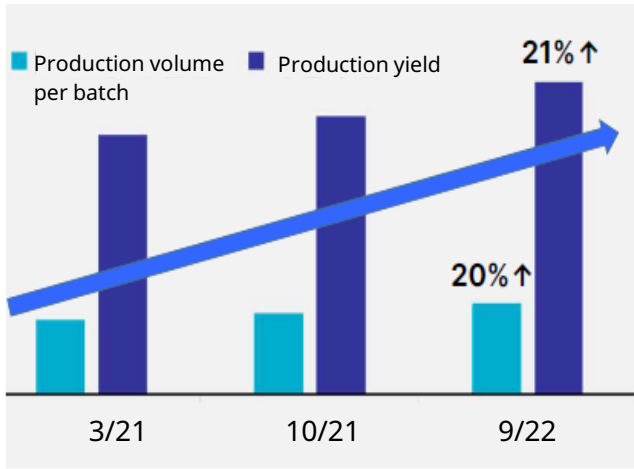
2) LNP technology

ST Pharm has three LNP technologies: 1) an LNP technology licensed from Genevant Sciences; 2) STLNP, an internally developed technology that was patented in Korea in 2020; and 3) SMARTLNP, which is being jointly developed with Professor Lee. The company is also developing a system to produce LNP at scale and has so far validated mass production of 140 channels through joint research with Inventage Lab (microfluidics system manufacturer) and Professor Kim Dong-pyo of Pohang University of Science and Technology.

3) Productivity enhancements

ST Pharm is looking at a number of ways to enhance its oligo production efficiency. In synthesizing oligos, the company applies a technology that uses dimers rather than monomers. The company has said that this technology can improve purity by 11-13%; specifically, during the synthesis and refinement process, the use of dimers makes it easier to remove oligos that are not properly synthesized.

Figure 5. Production volume per batch and yield have increased 20% and 21%, respectively



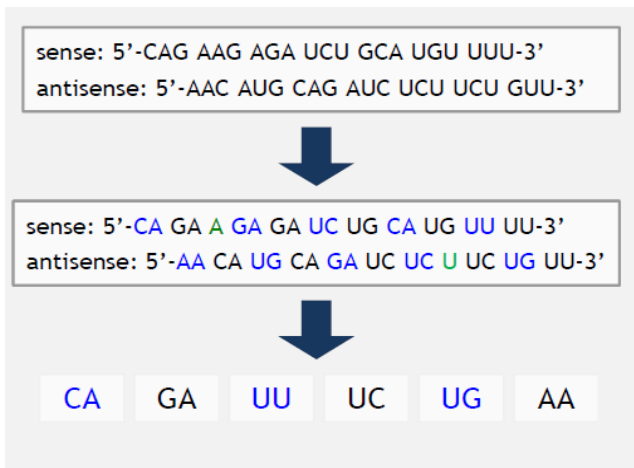
Source: Company materials, Mirae Asset Securities Research

Figure 6. Manufacturing time and costs have improved by 28% and 51%, respectively



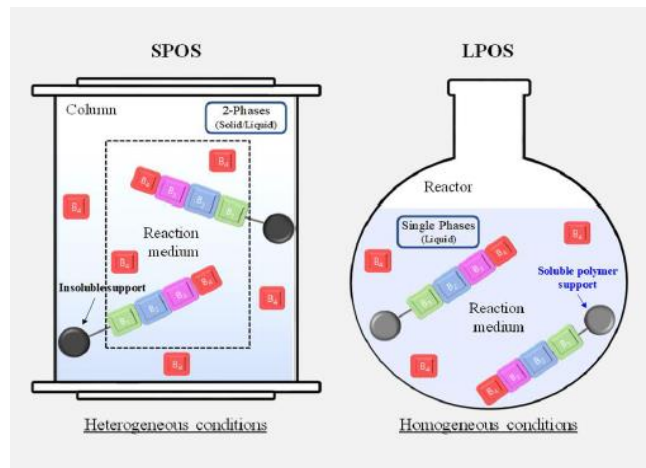
Source: Company materials, Mirae Asset Securities Research

Figure 7. Synthesis technology using dimers



Source: Company materials, Mirae Asset Securities Research

Figure 8. LPOS technology better suited for mass production



Source: Company materials, Mirae Asset Securities Research

3. Competitiveness validated by earnings and orders

To meet surging demand for oligos, ST Pharm carried out three capacity ramp-ups over the course of 2020 and 2021. The company increased annual capacity from 2 mol (600kg) in 2021 to 6.4 mol (2 tonnes) in 4Q22, and is planning to raise capacity further to 10.2 mol (3 tonnes) in 3Q24 and 14 mol (4 tonnes) in 1Q26. Rival Nitto Avecia is expected to expand its capacity from 1.4 tonnes to 2.8 tonnes in 2023, while Agilent Technologies is expected to expand its capacity to 4 tonnes in 2026.

ST Pharm has seen its order flows steadily grow after establishing a track record with global pharmas. The company supplies APIs for a number of treatments in the pipeline, including two that have been commercialized. In 2021-22, the company won contracts worth US\$20mn to supply lipids for LNPs used in an mRNA therapy.

Table 1. Major oligo CDMO facilities

Company	Timeline	Total capacity	Facilities
ST Pharm	2021	2.0 mol (330 kg-1 tonne)	One line
	2022	6.4 mol (1-3.2 tonnes)	Four lines
	3Q24F	10.2 mol (1.7-5.1 tonnes)	Seven lines
	1Q26F	14.0 mol (2.3-7 tonnes)	10 lines
Agilent Technologies	2019		Boulder facility
	2019-2Q23F	1 tonne	Boulder facility + Frederick facility line A
	2Q23F-2026F	2 tonnes	Boulder facility + Frederick facility lines A and B
	2026F	4 tonnes	Boulder facility + Frederick facility lines A, B, C, and D
Nitto Avecia	Jul. 2017	1.2 mol	Existing lines of Milford facility
	Aug. 2017-1H23F	3.0 mol (1.4 tonnes)	Existing lines of Milford facility + line 1 of new facility
	1H23F	N/A (estimated to be 2.8 tonnes)	Existing lines of Milford facility + lines 1 and 2 of new facility

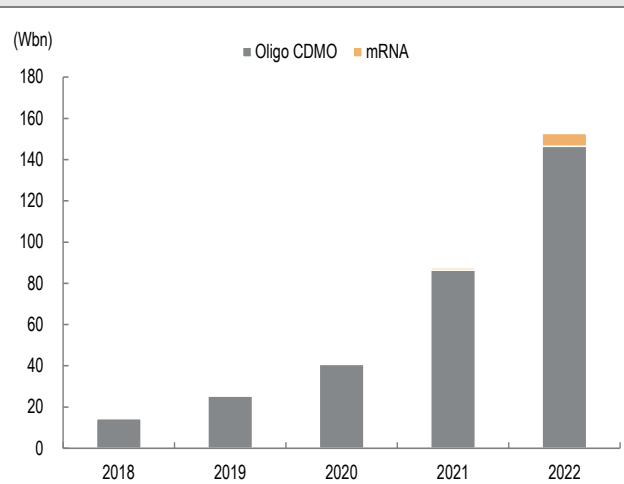
Source: Company data, Mirae Asset Securities Research

Figure 9. ST Pharm's oligo order pipeline (partial)

Partner	Indication	Phase
Global pharma company A	Hyperlipidemia	Commercialization
Global pharma company B	Spinal muscular atrophy	Commercialization
Global pharma company A	Arteriosclerosis	Phase 3
Global biotech company C	MDS/MF	Phase 3
Global biotech company D	Cardiovascular disease	Phase 3
Global pharma company E	Hepatitis B	Phase 3
Global pharma F	Hepatitis B	Phase 2
Global pharma company G	Thrombosis	Phase 2
Global biotech company D	Hereditary angioedema	Phase 2

Source: Company data, Mirae Asset Securities Research

Figure 10. ST Pharm's oligo CDMO revenue



Source: Company data, Mirae Asset Securities Research

Table 2. Oligo- and mRNA-related orders

(US\$mn)

	Order date	Delivery date	Indication	Total order value	Orders fulfilled	Order backlog
Oligo APIs	Nov. 2017	Dec. 2020	Huntington's disease	11.8	11.8	-
	Mar. 2019	Mar. 2020	Atherosclerosis	7.8	7.8	-
	Sep. 2021	May 2022	Blood cancer	15.3	10.4	4.9
	Nov. 2019	May 2020	Atherosclerosis	3.4	3.4	-
	Nov. 2019	Dec. 2020	Cardiovascular disease	4.6	4.6	-
	Apr. 2020	Dec. 2021	Autism	5.7	5.7	-
	May 2020	Dec. 2020	Chronic hepatitis B	3.4	3.4	-
	May 2021	Jul. 2021	Huntington's disease	CHF21.12mn	CHF21.1mn	-
	Sep. 2020	Mar. 2022	Hyperlipidemia	38.7	28.2	10.6
	Dec. 2020	Aug. 2023	Autism	CHF7.009mn	CHF7.0mn	-
	Dec. 2020	Mar. 2023	Chronic hepatitis B	11.2	4.2	7.0
	Jan. 2021	Jun. 2022	Atherosclerosis	9.9	-	9.9
	Mar. 2021	Jun. 2023	Cardiovascular disease	5.5	-	5.5
	Dec. 2021	Sep. 2023	Atherosclerosis	12.8	-	12.8
	Mar. 2021	Jun. 2023	Cardiovascular disease	9.6	9.6	-
	Oct. 2021	Dec. 2022	Macular degeneration	CHF5.516mn	CHF4.3mn	CHF1.2mn
	Dec. 2021	Sep. 2023	Atherosclerosis	CHF12.798mn	-	CHF12.8mn
	mRNA vaccine APIs, etc.	Mar. 2022	Jan. 2023	Hyperlipidemia (commercialized)	65.3	28.3
May 2022		Sep. 2023	Chronic hepatitis B	CHF4.09mn	-	CHF4.1mn
Jul. 2022		Dec. 2023	Blood cancer (commercialized)	5.7	-	5.7
Aug. 2021		Jan. 2022	Lipids for LNP	1.0	1.0	-
Nov. 2021		May 2022		1.1	-	1.1
Dec. 2021	May 2022	4.0		-	4.0	
May 2022	Jun. 2023	14.0		-	14.0	

Source: Company data, Mirae Asset Securities Research

4. Valuation

We initiate coverage of ST Pharm with a Buy rating and target price of W120,000. Our valuation reflects a DCF-based operating value of W2.3tr minus W19.9bn in net debt.

In 2022, ST Pharm's revenue grew 50.5% YoY to W249.3bn. Operating profit surged 219.5% YoY to W17.8bn, yielding an OP margin of 7.2%. We expect the company to secure new orders amid the growth of the RNA therapeutics market. Production volume should also increase on the back of clinical progress in RNA therapeutics for which the company is already producing APIs. The 3.8 mol capacity addition in 3Q24 should lead to revenue growth. And following another 3.8 mol capacity expansion in 2026, we believe COGS ratio and SG&A expenses will become less volatile in 2028. We see OP margin reaching 29% in 2030 as production stabilizes.

Table 3. Earnings and forecasts

(W100mn)

	1Q22	2Q22	3Q22	4Q22	1Q23F	2Q23F	3Q23F	4Q23F	2021	2022	2023F	2024F	
Revenue	370	511	608	1,004	636	695	741	776	1,656	2,493	2,848	3,511	
YoY	35.7%	26.7%	31.4%	94.1%	72.0%	35.9%	21.9%	-22.7%	33.5%	50.5%	14.2%	23.3%	
New drug API	Small molecules	7	1	60	85	38	46	57	57	179	153	199	238
	Oligos	168	270	393	633	366	416	452	467	865	1,464	1,701	2,211
	mRNA	12	35	14	1	28	25	23	26	9	63	102	204
Generics API	Generics	60	118	60	162	100	110	108	120	334	400	438	448
	Other (incl. CRO)	123	87	80	122	103	98	101	106	265	413	408	410
OP	5	35	45	102	64	83	96	70	56	188	313	615	
YoY	TTB	-27.5%	-41.6%	TTB	1085.4%	135.9%	112.2%	-24.2%	TTB	219.5%	75.7%	96.5%	
NP	21	34	99	20	51	67	77	56	34	186	215	2,191	
YoY	TTB	-40.2%	28.2%	TTB	137.3%	97.0%	-22.3%	174.4%	TTB	417.8%	43.3%	96.5%	

Source: Company data, Mirae Asset Securities Research

Table 4. Valuation table

(Wbn)

	Value	Notes
Operating value (A=B+C)	2,330	
Sum of PV of FCF (B)	432	
PV of terminal value (C)	1,898	
Net debt (D)	20	As of end-2022
Value (E=A-D)	2,310	
No. of shares (F, '000)	18,809	
Target price (G=E/F, W)	120,000	
Current share price (W)	75,000	
Upside potential (%)	60.0%	

Source: Mirae Asset Securities Research

ST Pharm (237690 KQ)

Income statement (summarized)

(Wbn)	2021	2022F	2023F	2024F
Revenue	166	249	285	351
Cost of revenue	108	160	180	212
GP	58	89	105	139
SG&A expenses	52	71	73	77
OP (adj.)	6	18	31	62
OP	6	18	31	62
Non-operating profit	-5	1	0	0
Net financial income	-4	0	0	0
Net income from associates	0	0	0	0
Pretax profit	1	19	31	62
Income tax	-2	2	6	12
Profit from continuing operations	3	17	25	49
Profit from discontinued operations	0	0	0	0
NP	3	17	25	49
Attributable to owners	3	18	26	51
Attributable to minority interests	0	0	-1	-1
Total comprehensive income	5	18	25	49
Attributable to owners	5	18	25	50
Attributable to minority interests	0	0	0	0
EBITDA	20	34	48	78
FCF	-45	-118	16	8
EBITDA margin (%)	12.0	13.7	16.8	22.2
OP margin (%)	3.6	7.2	10.9	17.7
Net margin (%)	1.8	7.2	9.1	14.5

Balance sheet (summarized)

(Wbn)	2021	2022F	2023F	2024F
Current assets	244	289	281	323
Cash & equivalents	39	22	29	9
AR & other receivables	64	69	64	73
Inventory	81	191	183	234
Other current assets	60	7	5	7
Non-current assets	254	291	315	308
Investments in associates	0	0	0	0
PP&E	209	245	270	264
Intangible assets	13	13	12	12
Total assets	499	580	596	631
Current liabilities	75	120	123	116
AP & other payables	21	13	16	19
Short-term financial liabilities	16	69	69	50
Other current liabilities	38	38	38	47
Non-current liabilities	97	123	120	122
Long-term financial liabilities	92	112	112	112
Other non-current liabilities	5	11	8	10
Total liabilities	173	243	243	238
Equity attributable to owners	323	334	350	392
Capital stock	9	9	9	9
Capital surplus	196	196	196	196
Retained earnings	116	124	140	181
Minority interests	3	3	3	1
Shareholders' equity	326	337	353	393

Cash flow statement (summarized)

(Wbn)	2021	2022F	2023F	2024F
Operating cash flow	7	-66	56	18
NP	3	17	25	49
Non-cash income/expenses	25	23	23	29
Depreciation	14	15	16	16
Amortization	0	1	1	1
Other	11	7	6	12
Chg. in working capital	-21	-103	15	-47
Chg. in AR & other receivables	-6	-71	5	-8
Chg. in inventory	-37	-110	9	-51
Chg. in AP & other payables	8	9	3	4
Income tax	0	-3	-6	-12
Cash flow from investing activities	-8	11	-40	-10
Chg. in PP&E	-51	-50	-40	-10
Chg. in intangible assets	0	0	0	0
Chg. in financial assets	40	46	0	0
Other	3	15	0	0
Cash flow from financing activities	0	38	-9	-29
Chg. in financial liabilities	-19	74	0	-19
Chg. in equity	21	0	0	0
Dividends	0	-9	-9	-9
Other	-2	-27	0	-1
Chg. in cash	1	-17	7	-20
Beginning balance	39	39	22	29
Ending balance	39	22	29	9

Source: Company data, Mirae Asset Securities Research estimates

Key valuation metrics/ratios

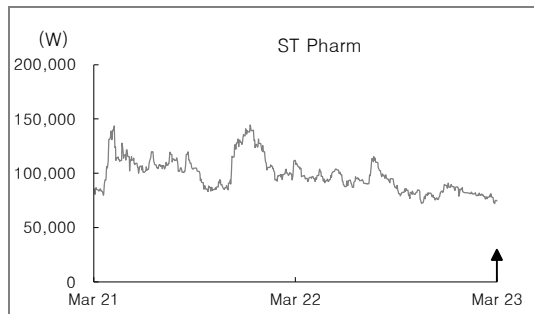
	2021	2022F	2023F	2024F
P/E (x)	784.2	93.6	54.8	27.9
P/CF (x)	93.1	41.0	29.5	18.1
P/B (x)	8.1	4.9	4.0	3.6
EV/EBITDA (x)	131.3	53.8	32.8	20.1
EPS (W)	177	936	1,369	2,690
CFPS (W)	1,495	2,137	2,541	4,148
BPS (W)	17,171	17,763	18,632	20,822
DPS (W)	500	500	500	500
Dividend payout ratio (%)	278.5	53.8	37.5	19.1
Dividend yield (%)	0.4	0.6	0.7	0.7
Revenue growth (%)	33.5	50.5	14.2	23.3
EBITDA growth (%)	-	68.3	42.0	63.3
OP growth (%)	-	219.5	75.7	96.5
EPS growth (%)	-	427.1	46.3	96.5
AR turnover (x)	3.1	3.8	4.4	5.3
Inventory turnover (x)	2.6	1.8	1.5	1.7
AP turnover (x)	12.3	12.6	12.8	12.3
ROA (%)	0.7	3.2	4.3	8.0
ROE (%)	1.1	5.4	7.5	13.6
ROIC (%)	5.2	3.9	5.2	9.7
Debt-to-equity ratio (%)	52.9	71.9	68.9	60.7
Current ratio (%)	323.9	240.4	228.8	277.5
Net debt-to-equity ratio (%)	7.5	47.2	43.2	39.1
Interest coverage ratio (x)	1.1	0.0	0.0	0.0

Appendix 1

Important disclosures and disclaimers

Two-year rating and TP history

Company	Date	Rating	TP (₩)
ST Pharm (237690)	03/20/23	Buy	120,000



Stock ratings

Buy	Expected 12-month performance: +20% or greater
Trading Buy	Expected 12-month performance: +10% to +20%
Hold	Expected 12-month performance: -10% to +10%
Sell	Expected 12-month performance: -10% or worse

Sector ratings

Overweight	Expected to outperform the market over 12 months
Neutral	Expected to perform in line with the market over 12 months
Underweight	Expected to underperform the market over 12 months

Rating and TP history: Share price (—), TP (—), Not Rated (■), Buy (▲), Trading Buy (■), Hold (●), Sell (◆)

* Our investment rating is a guide to the expected return of the stock over the next 12 months.

* Outside of the official ratings of Mirae Asset Securities Co., Ltd., analysts may call trading opportunities should technical or short-term material developments arise.

* The TP was determined by the research analyst through valuation methods discussed in this report, in part based on estimates of future earnings.

* TP achievement may be impeded by risks related to the subject securities and companies, as well as general market and economic conditions.

Ratings distribution and investment banking services

	Buy	Trading Buy	Hold	Sell
Ratings distribution	85.18%	8.89%	5.19%	0.74%
Investment banking services	83.33%	16.67%	0%	0%

* Based on recommendations in the last 12-months (as of December 31, 2022)

Disclosures

As of the publication date, Mirae Asset Securities Co., Ltd. and/or its affiliates do not have any special interest with the subject company and do not own 1% or more of the subject company's shares outstanding.

Analyst certification

The research analysts who prepared this report (the "Analysts") are registered with the Korea Financial Investment Association and are subject to Korean securities regulations. They are neither registered as research analysts in any other jurisdiction nor subject to the laws or regulations thereof. Each Analyst responsible for the preparation of this report certifies that (i) all views expressed in this report accurately reflect the personal views of the Analyst about any and all of the issuers and securities named in this report and (ii) no part of the compensation of the Analyst was, is, or will be directly or indirectly related to the specific recommendations or views contained in this report. Mirae Asset Securities Co., Ltd. ("Mirae Asset Securities") policy prohibits its Analysts and members of their households from owning securities of any company in the Analyst's area of coverage, and the Analysts do not serve as an officer, director, or advisory board member of the subject companies. Except as otherwise specified herein, the Analysts have not received any compensation or any other benefits from the subject companies in the past 12 months and have not been promised the same in connection with this report. Like all employees of Mirae Asset Securities, the Analysts receive compensation that is determined by overall firm profitability, which includes revenues from, among other business units, the institutional equities, investment banking, proprietary trading, and private client divisions. At the time of publication of this report, the Analysts do not know or have reason to know of any actual, material conflict of interest of the Analyst or Mirae Asset Securities except as otherwise stated herein.

Disclaimers

This report was prepared by Mirae Asset Securities, a broker-dealer registered in the Republic of Korea and a member of the Korea Exchange. Information and opinions contained herein have been compiled in good faith and from sources believed to be reliable, but such information has not been independently verified and Mirae Asset Securities makes no guarantee, representation or warranty, express or implied, as to the fairness, accuracy, completeness, or correctness of the information and opinions contained herein or of any translation into English from the Korean language. In case of an English translation of a report prepared in the Korean language, the original Korean language report may have been made available to investors in advance of this report. The intended recipients of this report are sophisticated institutional investors who have substantial knowledge of the local business environment, its common practices, laws, and accounting principles, and no person whose receipt or use of this report would violate any laws or regulations or subject Mirae Asset Securities or any of its affiliates to registration or licensing requirements in any jurisdiction shall receive or make any use hereof.

This report is for general information purposes only and is not and shall not be construed as an offer or a solicitation of an offer to effect transactions in any securities or other financial instruments. The report does not constitute investment advice to any person, and such person shall not be treated as a client of Mirae Asset Securities by virtue of receiving this report. This report does not take into account the particular investment objectives, financial situations, or needs of individual clients. The report is not to be relied upon in substitution for the exercise of independent judgment. Information and opinions contained herein are as of the date hereof and are subject to change without notice. The price and value of the investments referred to in this report and the income from them may depreciate or appreciate, and investors may incur losses on investments. Past performance is not a guide to future performance. Future returns are not guaranteed, and a loss of original capital may occur. Mirae Asset Securities, its affiliates, and their directors, officers, employees, and agents do not accept any liability for any loss arising out of the use hereof.

Mirae Asset Securities may have issued other reports that are inconsistent with, and reach different conclusions from, the opinions presented in this report. The reports may reflect different assumptions, views, and analytical methods of the analysts who prepared them. Mirae Asset Securities may make investment decisions that are inconsistent with the opinions and views expressed in this research report. Mirae Asset Securities, its affiliates, and their directors, officers, employees, and agents may have long or short positions in any of the subject securities at any time and may make a purchase or sale, or offer to make a purchase or sale, of any such securities or other financial instruments from time to time in the open market or otherwise, in each case either as principals or agents. Mirae Asset Securities and its affiliates may have had, or may be expecting to enter into, business relationships with the subject companies to provide investment banking, market-making, or other financial services as are permitted under applicable laws and regulations.

No part of this document may be copied or reproduced in any manner or form or redistributed or published, in whole or in part, without the prior written consent of Mirae Asset Securities. For further information regarding company-specific information as it pertains to the representations and disclosures in this Appendix 1, please contact compliance@miraeeasset.us.com or +1 (212) 407-1000.

Distribution

United Kingdom: This report is being distributed by Mirae Asset Securities (UK) Ltd. in the United Kingdom only to (i) investment professionals falling within Article 19(5) of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (the "Order"), and (ii) high net worth companies and other persons to whom it may lawfully be communicated, falling within Article 49(2)(A) to (E) of the Order (all such persons together being referred to as "Relevant Persons"). This report is directed only at Relevant Persons. Any person who is not a Relevant Person should not act or rely on this report or any of its contents.

United States: Mirae Asset Securities is not a registered broker-dealer in the United States and, therefore, is not subject to U.S. rules regarding the preparation of research reports and the independence of research analysts. This report is distributed in the U.S. by Mirae Asset Securities (USA) Inc., a member of FINRA/SIPC, to "major U.S. institutional investors" in reliance on the exemption from registration provided by Rule 15a-6(b)(4) under the U.S. Securities Exchange Act of 1934, as amended. All U.S. persons that receive this document by their acceptance hereof represent and warrant that they are a major U.S. institutional investor and have not received this report under any express or implied understanding that they will direct commission income to Mirae Asset Securities or its affiliates. Any U.S. recipient of this document wishing to effect a transaction in any securities discussed herein should contact and place orders with Mirae Asset Securities (USA) Inc. Mirae Asset Securities (USA) Inc. accepts responsibility for the contents of this report in the U.S., subject to the terms hereof, to the extent that it is delivered to a U.S. person other than a major U.S. institutional investor. Under no circumstances should any recipient of this research report effect any transaction to buy or sell securities or related financial instruments through Mirae Asset Securities. The securities described in this report may not have been registered under the U.S. Securities Act of 1933, as amended, and, in such case, may not be offered or sold in the U.S. or to U.S. persons absent registration or an applicable exemption from the registration requirements.

Hong Kong: This report is distributed in Hong Kong by Mirae Asset Securities (HK) Limited, which is regulated by the Hong Kong Securities and Futures Commission. The contents of this report have not been reviewed by any regulatory authority in Hong Kong. This report is for distribution only to professional investors within the meaning of Part I of Schedule 1 to the Securities and Futures Ordinance of Hong Kong (Cap. 571, Laws of Hong Kong) and any rules made thereunder and may not be redistributed in whole or in part in Hong Kong to any person.

India: This report is being distributed by Mirae Asset Capital Markets (India) Private Limited ("MACM") in India to the customers based in India and is personal information only for those authorised recipient(s). MACM is inter alia a Securities and Exchange Board of India ("SEBI") registered Research Analyst in India and is not registered outside India. MACM and Mirae Asset, Korea are group entities. MACM makes no guarantee, representation or warranty, express or implied, as to the fairness, accuracy, completeness or correctness of the information and opinions contained herein. The user assumes the entire risk of any use made of this information. This report has been provided for assistance only and is not intended to be and must not alone be taken as the basis for an investment decision. Recipient must read the entire Appendix 1 to the report carefully for Important Disclosures & Disclaimers.

All other jurisdictions: Customers in all other countries who wish to effect a transaction in any securities referenced in this report should contact Mirae Asset Securities or its affiliates only if distribution to or use by such customer of this report would not violate applicable laws and regulations and not subject Mirae Asset Securities and its affiliates to any registration or licensing requirement within such jurisdiction.

Mirae Asset Securities International Network

Mirae Asset Securities Co., Ltd. (Seoul)

One-Asia Equity Sales Team
Mirae Asset Center 1 Building
26 Eulji-ro 5-gil, Jung-gu, Seoul 04539
Korea

Tel: 82-2-3774-2124

Mirae Asset Securities (USA) Inc.

810 Seventh Avenue, 37th Floor
New York, NY 10019
USA

Tel: 1-212-407-1000

PT. Mirae Asset Sekuritas Indonesia

District 8, Treasury Tower Building Lt. 50
Sudirman Central Business District
Jl. Jend. Sudirman, Kav. 52-54
Jakarta Selatan 12190
Indonesia

Tel: 62-21-5088-7000

Mirae Asset Securities Mongolia UTsK LLC

#406, Blue Sky Tower, Peace Avenue 17
1 Khoroo, Sukhbaatar District
Ulaanbaatar 14240
Mongolia

Tel: 976-7011-0806

Shanghai Representative Office

38T31, 38F, Shanghai World Financial Center
100 Century Avenue, Pudong New Area
Shanghai 200120
China

Tel: 86-21-5013-6392

Mirae Asset Securities (HK) Ltd.

Units 8501, 8507-8508, 85/F
International Commerce Centre
1 Austin Road West
Kowloon
Hong Kong

Tel: 852-2845-6332

Mirae Asset Wealth Management (USA) Inc.

555 S. Flower Street, Suite 4410,
Los Angeles, California 90071
USA

Tel: 1-213-262-3807

Mirae Asset Securities (Singapore) Pte. Ltd.

6 Battery Road, #11-01
Singapore 049909
Republic of Singapore

Tel: 65-6671-9845

Mirae Asset Investment Advisory (Beijing) Co., Ltd

2401B, 24th Floor, East Tower, Twin Towers
B12 Jianguomenwai Avenue, Chaoyang District
Beijing 100022
China

Tel: 86-10-6567-9699

Ho Chi Minh Representative Office

7F, Saigon Royal Building
91 Pasteur St.
District 1, Ben Nghe Ward, Ho Chi Minh City
Vietnam

Tel: 84-8-3910-7715

Mirae Asset Securities (UK) Ltd.

41st Floor, Tower 42
25 Old Broad Street,
London EC2N 1HQ
United Kingdom

Tel: 44-20-7982-8000

Mirae Asset Wealth Management (Brazil) CCTVM

Rua Funchal, 418, 18th Floor, E-Tower Building
Vila Olimpia
Sao Paulo - SP
04551-060
Brazil

Tel: 55-11-2789-2100

Mirae Asset Securities (Vietnam) LLC

7F, Saigon Royal Building
91 Pasteur St.
District 1, Ben Nghe Ward, Ho Chi Minh City
Vietnam

Tel: 84-8-3911-0633 (ext.110)

Beijing Representative Office

2401A, 24th Floor, East Tower, Twin Towers
B12 Jianguomenwai Avenue, Chaoyang District
Beijing 100022
China

Tel: 86-10-6567-9699 (ext. 3300)

Mirae Asset Capital Markets (India) Pvt Ltd

1st Floor, Tower 4, Equinox Business Park,
LBS Marg, Off BKC, Kurla (West), Mumbai - 400 070
India

Tel: 91-22-62661300 / 48821300
