# JOURNAL OF FINANCE CASE RESEARCH

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Title page, Masthead, Letter from the Editor, Contents

## *CONTENTS*

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## CONTENTS

# Letter from the Editor

Welcome to the Fall 2007 issue of the *Journal of Finance Case Research*, the official journal of *The Institute of Finance Case Research* (IFCR). Volume 9, Number 2 is the second of two issues for 2007. I would like to express my thanks to the authors, reviewers and other supporters who have helped us get another issue put together.

The IFCR provides an avenue for the writing of cases and their submission for peer review. Cases accepted for publication in the *Journal* have met the requirements of a double-blind review process, and are available for use through *Journal* subscriptions or by contacting the *Institute* for multiple copies (for a small fee per copy of the case). Teaching notes are available to instructors desiring to use each case by contacting the *Institute*. Our acceptance rate has been consistently 25% or less. The *Journal* is listed in *Cabell's Directory of Publishing Opportunities in Economics and Finance* and other standard references.

In addition to the *Journal*, the *Institute* continues to promote the interaction of case writers in a conference setting. Cases submitted for conference presentation are eligible for the review process for the *Journal*. Our overall objective is to create an outlet for case writers, and a source of high quality cases for case users.

I would like to personally invite case writers and case teachers to participate in the activities of the *Institute*. Our case sessions have been held at a variety of finance conferences, and they provide an excellent opportunity for interaction with others with similar interests. The journal has sponsored or participated in case or teaching sessions at annual meetings of the Southwestern Case Research Association, the Financial Management Association, the Southwest Finance Association, the Midwest Finance Association, the Academy of Economics and Finance and the Financial Education Association. Historically, cases presented at conferences have had more success in getting published, perhaps because of the scrutiny and comments they receive from other educators.

The *Journal* reviews and accepts cases of all types, as is evident from the content of this issue. Primarily, though, we want the *Journal* to be an outlet for interesting and challenging cases. We have focused on decision cases in the past, both "textbook"-style directed cases and also more involved, open cases. In every instance, we are seeking cases that will be relevant and engaging for students and professors alike.

As I have mentioned in the past several issues, the *Institute* is currently planning to create an outlet for shorter problems, classroom exercises, and teaching ideas to debut in 2008. Some of our colleagues have been using short exercises in class for many years, and I hope folks will send those in and have them editorially reviewed and published the *Journal's* sister publication.

Finally, I would like to encourage all of our readers to consider volunteering to review manuscripts as schedules permit. Finding reviewers is a key part of the managing editor's job, and it is becoming more and more difficult as the volume of manuscripts increases.

This issue of the *Journal of Finance Case Research* contains six interesting and timely cases and a demonstration of one method for valuing real options. I urge you to put all of these to good use in your classes and seminars.

For additional information about the *Journal* and the *Institute*, please go to ***jfcr.org*** on the Web.

**Timothy B. Michael, Managing Editor**
***Journal of Finance Case Research***

# THE APARTMENT PARTNERSHIP

**Brian A. Maris, Northern Arizona University**
**Jo-Mae B. Maris, Northern Arizona University**

*Christopher Daniels and Andrew Zachary are university professors who have decided to buy an apartment house. Each has $100,000 to invest in the venture and both are willing to work toward its success. There are a few issues that remained to be ironed out however. Christopher is nearing retirement and plans to sell the apartments within five or six years. Andrew, on the other hand, had in mind keeping the building at least until the 15-year mortgage could be paid off.*

## PROFESSOR AND MRS. DANIELS

Christopher Daniels is a professor in the Anthropology Department of Northern Arizona University (NAU), located in Flagstaff, AZ. Flagstaff, the largest city in northern Arizona, had a population of 60,000 in 2002. NAU is a state university, and had about 13,000 students on campus at that time. Since 1976, when Christopher joined the University after receiving his PhD, the population of Flagstaff has increased about 50 percent, and enrollment at NAU has approximately doubled. His younger son graduated from Arizona State in 2000, and in the fall of 2001 Christopher began anticipating retirement, which he expected to occur in 2007, when he reaches 62. He also began wondering what he could do to better prepare financially for retirement. His salary, at $63,000 was about average for Professors in his Department, and he realized that Social Security plus his pension would fall short of that.

Early in the evening of November 1, 2002, Christopher sat at the computer in their home. His wife, Rachel asked him what he was working on so diligently. "You know that Andrew and I have been talking about buying some apartments and we looked at one last week that seems like a good fit. I'm just going over the numbers again."

"Tell me more."

"I want to do something to give us a stronger financial footing when I retire. If Andrew and I buy this apartment house, I believe we will earn enough to make a difference in our retirement."

"But won't that tie us down once you retire? I thought we agreed we would go back to our hometown once you retire."

"No, it won't be a problem. I only plan to do this until I retire."

"Andrew is a lot younger than you are. What if he doesn't want to sell when you do?" asked Rachel. "Don't worry. We'll work that out when the time comes. I'm sure it won't be a problem. Have a seat and I'll show you the numbers." (See Exhibit 1.)

"Wow, you guys really have this figured out. How did you come up with all of these numbers and measures?" "Andrew bought a book on investing in real estate. We got the income multipliers and measures of profitability there. The apartment rent, according to the real estate

agent, is $640 per month. She also gave us the monthly payments on the mortgage. The apartments are all rented now, and we estimated the vacancy rate and losses from uncollected rent at ten percent."

"Did you ask the owner or manager what the operating expenses have been?"

"No, but I believe we are pretty close. We used averages based on purchase cost from the real estate book for operating expenses."

"Are you sure you can hire a real estate management company for $2,000 per year?" asked Rachel. "That seems awfully low."

"That's just for office supplies and advertising. Andrew and I are going to manage it. I am not doing as much research as I once did, and I believe I have the time to do this."

"How much time will it take? Managing an apartment house seems like a lot of work to me."

"I'm not sure, but it can't be that bad. It's only ten apartments."

"I don't understand how you came up with the tax effects. Why won't we owe taxes on the net income? And how can we save $6,000 per year on operating expense and interest paid?" asked Rachel.

"It's really very simple," said Christopher. "The depreciation expense will be enough to offset the income. Then we can deduct the interest expense and operating expenses, and get a tax saving from them."

"Are you sure about that? It seems too good to be true."

"Don't worry. Our real estate investment book explains the whole thing."

After thinking about it for a few minutes, Rachel asked, "What do you suppose it will be worth when you sell?" Christopher responded, "I don't know, but housing prices have done nothing but go up." "Yes," said Rachel, but I wonder how much." "It's anybody's guess," said Christopher.

Two days later over dinner, Rachel brought up the apartments. "I drove by that building you and Andrew are looking at. It's in a great location, but don't you think it needs to be painted? What does the inside look like?"

"You're right. It is in a great location, near campus, and it does need to be painted, inside and out. Andrew says he can take care of maintenance. I think he'll be able to paint it next summer."

"Really? The whole thing? That seems like a big job."

"He plans to hire a student to help and he enjoys that sort of thing."

## PROFESSOR ZACHARY

Andrew Zachary, also a Professor in the Anthropology Department, turned 44 early in 2001, soon after he and his wife divorced. His wife retained custody of their two children, and relocated out of state. Andrew had always enjoyed being "Harry Homeowner" and actually missed that when he moved into an apartment. Pretty soon he started looking at duplexes, with the idea that he would live in one unit and rent the other. During lunch with Christopher in January 2002, Andrew mentioned that he was considering buying a duplex. Over the next several months, the two discussed the local rental market and decided there were advantages in going in to the venture together. For one thing, by combining their savings, they could invest in a larger property. In addition, they trusted each other's judgment and believed that together the

venture was more likely to succeed. They discussed using professional management, but decided it was too expensive. Each brought different skills to the venture, but their skills were complimentary. Christopher was more outgoing, and was willing to take responsibility for renting vacant units, collecting rent, and relationships with tenants. Andrew was more of a "tool guy" and would be responsible for maintenance. They were not sure how much time would be required, but both believed it would take more of Andrew's time than of Christopher's.

Each was willing to invest up to $100,000 into the venture. As they discussed the idea, Andrew became more and more enthusiastic. He began looking into possible financing, with the idea of getting a 15-year mortgage. "Wow," he thought, "once the mortgage is paid off, almost all of the rent will be free and clear. I can retire early and live off my half of the rent."

During the summer of 2002, the two started scanning the local classified ads and looking at rental properties as they came on the market. In November, they looked at a 10-unit apartment house with a price of $525,000. It would require a slightly larger down payment than they had originally agreed, but seemed like a good opportunity. The building was approximately 20 years old and in reasonably good condition, but needed painting. Their real estate agent indicated that they could borrow up to 60 percent of the cost, on a 15-year mortgage with an interest rate of 8 percent. The projections in Exhibit 1 are based on that rate.

As Andrew thought about it, his enthusiasm grew. "As renters move out this summer, I should be able to paint at least half of the apartments," he thought. "We can hire a contractor to paint the exterior, and next year I can finish painting the interior. It will be great to earn some sweat equity."

As they discussed the building and went over the numbers in Exhibit 1, Andrew asked, "Which of these measures is our percentage return?" "I'm not sure. Why?" answered Christopher. "I think we should know what our percentage return is," said Andrew.

After looking over the table for a few minutes, Christopher responded by saying, "I think the ROI is our percentage return. Fourteen percent is a lot better than the stock market has been doing the past few years, and I don't know where we can do any better than that."

**Exhibit 1**
**ANNUAL OPERATING STATEMENT**
**Ten-Unit Apartment Building (Nov. 1, 2002)**

| | | |
|---|---|---|
| **Potential Gross Income** (10 units x $640 x 12 mos.) | | $76,800 |
| Less vacancy rate and rent loss (10%) | | -$6,800 |
| **Effective Gross Income** | | $70,000 |
| | | |
| **Less Operating Expenses** | | |
| Property Taxes | $5,000 | |
| Insurance | $3,000 | |
| Utilities | $6,000 | |
| Maintenance | $6,000 | |
| Management | $2,000 | |
| Other | $1,000 | |
| | $23,000 | -$23,000 |
| | | |
| **Net Operating Income** | | $47,000 |
| **Less debt service** ($315,000 @ 9% amortized over 15 years) | | $38,339 |
| **Cash flow before income tax** | | $8,661 |
| Less income tax on net income (canceled by depreciation) | | $0 |
| **Net cash flow in year 1** | | $8,661 |
| Save about $5,000 inc tax on op exp + $6,000 on int pd. | | $11,000 |
| Plus equity buildup in year 1 ($250 x 2.5 x 12 mos) | | $7,500 |
| **After tax cash flow in year 1** | | $27,161 |
| **After tax cash flow avg** 15 yrs = 5 + 9 + 15 = 29 | | $29,000 |

**Income multipliers/measures of profitability:**
Gross income multiplier = market price / effective gross income = 525 / 70 = 7.5
Net income multiplier = market price / net operating income = 525 / 47 = 11.17
Capitalization rate = net operating income / market price = 47 / 525 = .09
Equity dividend rate = net operating income - debt service / investment = 9 / 210 = .043
After tax (cash on cash) return yr 1 = after tax cash flow / investment = 27 / 210 = .129
After tax return (ROI) avg for 15 yrs = 29 / 210 = .138
(this does not count any appreciation or capital gains taxes after sale)
Payback period = initial cash outlay / avg annual cash flow = 210 / 29 = 7.2 years

| | | | |
|---|---|---|---|
| Purchase price | $525,000 | Down payment | $210,000 |
| Borrow | $315,000 | Interest rate | 9% |
| Term of loan | 15 years | Interest paid yr 1 | $24,000 |
| Avg interest pd/yr over 15 yrs | $17000/yr | Avg equity buildup | $17,500 |

Assumes future rents and expenses increase, but when discounted for present value are about the same as today's current amounts. Of course, debt service in future would be less in present value dollars (this is true of interest, equity buildup, and taxes saved).

**Exhibit 2**
**Information on market:**

Annual change in Flagstaff housing prices:

| Year | % Increase |
|---|---|
| 1996 | 5.7% |
| 1997 | 3.0 |
| 1998 | 3.3 |
| 1999 | 1.3 |
| 2000 | 4.7 |
| 2001 | 5.6 |

Median price of owner-occupied house in Flagstaff, 2002: $155,000, about 7% above the national average.

Rental vacancy rate: 5.3%

For tax purposes, buildings and improvements are depreciated straight-line to zero over 27 ½ years. The approximate value of the land on which the apartments are located in 2002 was $120,000.

The combined state and Federal income tax rate for Christopher and Andrew is 31%.

# IS THERE A LIGHT AT THE END OF THE EUROTUNNEL? [1]

**Andreas Schueler, Universitaet der Bundeswehr, Munich, Germany**

The British Prime Minister Margaret Thatcher and the French President François Mitterand announced in January 1986 that a fixed link between the United Kingdom and France should be built following the proposal submitted by France Manche S.A. and the Channel Tunnel Group Limited, together the later Eurotunnel Group. The system comprises of two single-track rail tunnels for train and shuttle services and one service tunnel. The Treaty between both governments stressed the point that the project was to be financed by private funds only (see Exhibit 1a). Nobody foresaw that it would become one of the most challenging project finance deals ever. The initial public offering of Eurotunnel in November 1987 was followed by unplanned capital increases in November 1990, May 1994 and October 1999. The initial debt financing had to be increased in 1990, completely restructured in 1997, when the project faced insolvency the first time, and revised again in 2002.

Now, in 2005, Eurotunnel's management has to negotiate with its lenders again about nothing less than its future: Operating cash flows are not even covering interest payable. The company faces insolvency again. Its shareholders are holding shares worth around 17 pence a piece, which were priced at £3.5 at the IPO and were quoted at about £11 in 1989. They have never received any dividends. Although the Eurotunnel is a highly-frequented way to cross the Channel and also led to positive infrastructure effects especially in Northern France, which is now even attracting commuters from London, the project has been a nightmare for lenders and shareholders (see for example Figure 3). What options do investors have in 2005? For answering that question, firstly, one needs to know how much money is on the table in case of the continuation of the project. This requires a valuation of Eurotunnel. Secondly, one has to think about how to distribute future cash flows. Will lenders agree to the proposal made by shareholders and management to write off around 60% of the loans outstanding, which currently amount to £6,354 million? Will lenders accept a debt-equity-swap as they did in 1997?

## BACKGROUND

The construction of the Eurotunnel began in December 1987. On May 6th 1994 most of the construction was completed and the tunnel was officially inaugurated by Queen Elizabeth II and François Mitterand.

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[1] The case was prepared for classroom discussion rather than to illustrate either effective or ineffective handling of an administrative situation. The conclusions drawn depend heavily upon the assumptions chosen.

The tunnel links the terminals in Folkstone/Britain and Coquelles/France. Its approximate length is 31 miles. The two rail tunnels are single-track rails and are used for trains running in one direction only. The maintenance tunnel is connected to each of the rail-tunnels and serves as a safe haven in case of accidents. In addition, there are four crossover points where trains can switch between the two rail tunnels while maintenance work is being carried out. On both sides of the channel, the terminals have direct access to motorways in order to ensure a fast travel experience.

The capacity of the tunnel is measured in standard paths per hour in each direction. The signalling system currently allows for 20 standard paths per hour in each direction. Eurotunnel uses 50% of the capacity, the remainder is used by other train operators (Eurostar and rail freight services by railway operators). Management believes that it can increase capacity to 24 paths per hour in each direction, although utilisation of all 24 paths will require improving traction power supply.

The operations of the Eurotunnel Group include shuttle business, railway business and ancillary business. The latter does not account for more than 5% of total revenues.

Firstly, Eurotunnel is a transportation service provider for freight and passengers. It can provide that service all year long, i.e. 24 hours on 365 days a year.

- Currently 9 passenger shuttles carry cars, caravans, trailers and coaches from one side of the Channel to the other. They can carry either 180 cars or 120 cars and 12 coaches. Passengers remain within their vehicles throughout the journey, which takes approximately 35 minutes. In peak times the system can ensure 4 departures per hour in each direction. Prices range from £39 per one way trip during off peak times for frequent travellers to £279 one way from Calais to Folkestone with a flexible ticket. The number of departures per year is 39,342 for 2001.[2]
- 16 freight shuttles carry on average 20 trucks (heavy goods vehicles, HGV). The drivers travel separately from their vehicles in 'Club cars' in order to enhance their safety. In peak times the system can handle 7 departures per hour in each direction. Tariffs are negotiated annually with freight customers on an individual basis. The number of departures is just over 60,000 per year.[3]

Secondly, the group manages the capacity not used for shuttle services and the infrastructure of the tunnel.

- It provides capacity for the Eurostar train and the Through Railfreight Services. Eurostar offers transportation for passengers between London and Paris as well as between London and Brussels. Some other connections, e.g. London to Avignon in southern France, are served as well. Railway companies use three different types of trains for freight services through the tunnel. There are intermodal trains, consisting of wagons carrying containers, conventional trains carrying palletised wrapped goods and automotive trains for the transport of cars. The annual fees consist of a fixed annual charge and a variable charge. The latter depends on the number of passengers respectively tons of freight passing the tunnel. A toll formula is used which also refers to inflation and volume thresholds. In addition, until 2006 the railways are obliged to make payments to Eurotunnel, if usage is below a minimum level.

[2] See Eurotunnel, Redemption of Equity Notes Prospectus, 2002, p. 14.

[3] See Eurotunnel, Summary Annual Report 2004, p. 5.

- Eurotunnel leases space to retailers in the terminals on either side of the channel. The tenants have to pay a fixed amount and/or a variable fee as a percentage of revenues.
- It provides infrastructure for commercial telecommunications business. This activity consists of laying and maintaining fibre optic cables in the tunnel.
-

## COMPETITORS

Generally speaking, Euro tunnel operates in the market for Channel crossings. Its core focus lies on the market for the so called Short Straits. This market segment includes routes between Dover, Folkestone or Ramsgate in the United Kingdom and Calais, Zeebrugge or Dunkerque on the European continent. Truck traffic concentrates on these Short Straits because of a fast Channel crossing and the variety of alternative carriers. Eurotunnel's main competitors are ferry operators like P&O Ferries, SeaFrance, Hoverspeed, Norfolkline and SpeedFerries. Competition in the passenger shuttle business between Britain and France arises also from low cost airlines offering another fast means of transportation and serving a variety of destinations.
Nevertheless, Eurotunnel is convinced to have three competitive advantages (at least compared to the ferries):

- Speed: Travelling time between autoroutes in France and motorways in Britain is shorter than for competing services.
- Frequency of departures: None of its rivals can match its frequency of departures.
- Dependability: The operating of the tunnel is not affected by adverse weather conditions.

Customer research has shown that passenger shuttle services are considered to be very good and customer loyalty has proven to be very high.

## HISTORY

The following time line gives an overview of the history of Eurotunnel from the project proposal to the present.

*Project Launch*

| | | |
|---|---|---|
| **1985** | March | Initiation of the project by the British and French governments |
| **1986** | January | Proposal of a rail tunnel system is chosen by the governments |
| | February | Franco-British Channel Tunnel Treaty is signed |
| | March | Signing of the Concession Agreement by the French and British governments, Channel Tunnel Group Ltd. and France Manche S.A.: BOOT-Project,[4] concession period until July 2042 |
| | August | Eurotunnel group is founded<br>Construction Contract is signed (commissioning date scheduled for May 1993) |
| | Sep./Oct. | First tranche of equity: £46 million provided by the founding consortium<br>Second tranche of equity: £206 million provided by institutional investors |
| **1987** | July | Ratification of the Treaty; Railway Usage Contract signed with British Rail and SNCF[5] |

[4] BOOT: Build, Own, Operate and Transfer.

| | | |
|---|---|---|
| | November | Credit Agreement: £5 billion; over 200 participating banks<br>IPO: £770 million |
| *Construction* | | |
| **1987** | December | Start of tunnelling |
| **1989** | July | First violation of covenants of the Credit Agreement |
| **1990** | October | Additional £1.8 billion bank loan, £300 million European Investment Bank (EIB) facility |
| | November | Seasoned equity offering (SEO): £568 million |
| | December | Breakthrough in the service tunnel<br>In exchange for waiving Eurotunnel's claims against the governments the concession period is extended to July 2052 |
| **1991** | November | Additional loan facility of £200 million by European Coal and Steel Community (ECSC) |
| **1992** | March | Violation of covenants |
| **1993** / **1994** | Dec. - May | Completion of the tunnel, fitting out, testing |
| *Operation* | | |
| **1994** | May | Official inauguration<br>Additional credit facility £647 million<br>SEO £858 million |
| | July | First rail freight trains, truck shuttles |
| | November | First Eurostar service |
| | December | First passenger shuttle |
| **1995** | June | First coach shuttle |
| | September | Standstill: Eurotunnel stops interest payments on junior debt |
| **1996** | October | Eurotunnel and banks outline financial restructuring |
| | November | Fire in the tunnel caused by a truck on a freight shuttle |
| **1997** | July | Shareholders agree with financial restructuring in extraordinary general meeting<br>Governments grant extension of the concession period until 2086 against 59% (incl. taxes) of pre-tax income starting 2052 |
| | November | Lenders agree with financial restructuring plan |
| **1999** | November | SEO for funding debt repurchases |
| **2002** | May | Restructuring claims of creditors: Buy back of subordinated debt below face value in exchange for new bonds |
| **2003** | September | Opening of the first part of the high speed line between Folkestone and London (UK terminal to Fawkham Junction, North Kent) |
| **2004** | February | Eurotunnel subsidiary is granted a rail operator's licence in France |
| | Spring | Revolt of shareholders leading to a change in management and demanding (in vain) financial support by the governments |
| **2005** | April | Eurotunnel obtains the waiver to the Credit Agreement required to start the renegotiation of its debt |

[5] SNCF: Société Nationale des Chemins de Fer

## CONSTRUCTION PERIOD

Due to the delays and technical difficulties during construction and also due to the unexpectedly high costs for the so called procurement items, mainly the specially designed shuttles, the financial capacity provided by the initial equity contributions (Equity 1 financed by the founding consortium, Equity 2 provided by institutional investors), by the IPO and the initial debt contracts was already exhausted in 1989. Before granting more loans, the banks required Eurotunnel to raise additional equity. This was achieved by the successful equity offering in November 1990, which resulted in an increase in equity of £568 million. Total loan facilities were increased from about £5,000 million to £7,300 million after that. Exhibit 3b summarizes those financial transactions and the next seasoned equity offer in 1994 as well as the additional senior debt financing of £647 million in 1994. Exhibit 3a shows how the construction costs estimated initially more than doubled till 1994 when the system was expected to fully operate. The cost overruns led to intense discussions between the Eurotunnel group and the construction consortium Trans Manche Link (TML) and also between the Eurotunnel group and the governments represented by the Intergovernmental Commission. One might note that during the start up phase the construction companies arguably faced a considerable conflict of interests: they were sitting on both sides of the table while negotiating the construction contract, since they were both founding shareholders (see Exhibit 2), i.e. principals, as well as agents, who had to design and build the tunnel and order shuttles etc. It also became clear that not all of the system's design had been specified clearly enough in advance. Safety prescriptions imposed by the IGC led to changes in the design of the tunnel and the shuttles leading to compensatory claims on behalf of Eurotunnel for the increased costs. Eurotunnel and the IGC settled their disputes on those issues in December 1993 as Eurotunnel waived its claims in exchange for a prolongation of the concession period from July 2042 to July 2052.

The total cost until opening increased also because of the delayed opening. Instead of an opening in May 1993, the system was fully operational only by the end of 1994. The cash inflows were therefore postponed by one and a half years. Besides that, management's cash flow forecast became less optimistic over time. Figure 2 summarizes the forecasts published for the various seasoned equity offerings. Using the cash flow forecasts and the price per unit, the internal rates of return before income taxes promised to investors were as follows:

**Table 1: Estimated Internal Rates of Return**

| | Unit price in £ | IRR in % |
|---|---|---|
| **IPO 1987** | 3.5 | 15.2 |
| **SEO 1990** | Average unit price during subscription period (November 12th – December 3rd): 3.62 | 11.8 |
| **SEO 1994** | Average unit price during subscription period (June 2nd – June 22nd): 3.17 | 8.9 |

Both SEO were rights issues, i.e. the subscription price and subscription rights have to be paid. The IRR are based upon the average unit price during each subscription period for the sake of simplicity. It becomes evident that the rate of return decreases significantly due to the revised

cash flow forecasts. Not surprisingly, the share price decreased considerably after the announcement of the rights issue 1994 and the publication of the cash flow forecast:

**Figure 1: Share Price around SEO 1994**


## OPERATIONS FROM OPENING TO PRESENT

After Eurotunnel became fully operational at the end of 1994, it seized a large market share fairly quickly. However, it did not meet the forecasted cash flows because of lower than expected revenues. Those were due to price wars with its direct competitors, the ferry companies. Eurotunnel competes also with discount airlines like Ryan Air which are serving flights between London and other European cities. Unfortunately, not only prices but volumes also failed to meet expectations. Table 2 shows how many vehicles, passengers and tons of freight have been transported over the last 10 years by shuttle and train.

## Table 2: Eurotunnel Traffic Volumes[6]

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Truck Vehicles (000)** | 65 | 391 | 519 | 267 | 705 | 839 | 1,133 | 1,198 | 1,231 | 1,285 | 1,281 |
| **Car Vehicles (000)** | 82 | 1,224 | 2,097 | 2,340 | 3,351 | 3,260 | 2,784 | 2,530 | 2,336 | 2,279 | 2,101 |
| **Coach Vehicles (000)** | 0 | 24 | 58 | 65 | 96 | 82 | 79 | 75 | 72 | 72 | 63 |
| **Eurostar Passengers (million)** | 0.16 | 2.92 | 4.87 | 6 | 6.3 | 6.6 | 7.1 | 6.9 | 6.6 | 6.32 | 7.28 |
| **Freight (million metric tons)** | 1.1 | 1.9 | 2.4 | 2.8 | 3.1 | 2.9 | 2.9 | 2.4 | 1.5 | 1.7 | 1.9 |
| **Market Shares (Short-Straits) (%)** | | | | | | | | | | | |
| **Truck** | 8 | 36 | 41 | 14 | 33 | 35 | 43 | 42 | 41 | 43 | n.a. |
| **Car** | 3 | 30 | 41 | 37 | 49 | 51 | 51 | 50 | 47 | 47 | n.a. |
| **Coach** | 0 | 13 | 27 | 28 | 39 | 34 | 35 | 35 | 33 | 36 | n.a. |

1995 was the first year of full operations. The fire at the end of 1996 had a negative effect on tunnel traffic in 1997 because of repair works. The system was shut down for almost 6 months. Table 3 compares the forecasts for 2003 with the actual figures. The number of passengers per car and coaches and the tons per HGV (heavy goods vehicle) are estimated in analogy to the IPO prospectus of Eurotunnel. It becomes evident that especially the number of passengers transported was heavily overestimated.

## Table 3: Traffic Volumes 2003: Forecast vs. Actual Figures

| | | Passengers (millions) | Freight (million tons) |
|---|---|---|---|
| **Actual** | **Cars · 2.55** | 5.81 | |
| | **Coaches · 25** | 1.80 | |
| | **Eurostar** | 6.32 | |
| | **Sum** | 13.93 | |
| **Actual** | **HGV · 11.7** | | 15.03 |
| | **Rail Freight** | | 1.70 |
| | **Sum** | | 16.73 |
| **Forecast** | **ET 1987** | 39.5 | 21.1 |
| | **ET 1990** | 44.6 | 26.8 |
| | **ET 1994** | 35.8 | 25.3 |

The increase in passengers travelling with Eurostar increased form 2003 to 2004, because of the opening of the first part of the high speed line between the UK terminal and London. Thanks to the completion of the second half by 2007, the time for a train journey from London to Paris will be further reduced by 15 minutes to 2 hours and 25 minutes. Nevertheless, this high speed link comes late compared to the French side where the high speed link has already been provided for.

However, not only the expectations concerning prices and traffic volumes but also concerning operational efficiency were not met. Operating costs in percent of revenues were expected to be 19% (IPO 1987), 25% (SEO 1990) and 27% (SEO 1994) respectively. In fact,

[6] Source: Eurotunnel; Fitch Rating.

they were 53% from 1995 to 2004 on average. Exhibit 4 summarizes additional key figures for that period.

In accordance with Clause 34 of the Concession Agreement (see Exhibit 1b), Eurotunnel submitted a feasibility study on a drive through tunnel to the British and French governments at the end of 1999. In doing so, Eurotunnel preserves an exclusive option to construct a second fixed link without any need to take a decision until 2010. If no agreement is reached between the governments and Eurotunnel, the governments are entitled to grant a concession to another company. In that case, the second link is not allowed to be opened before 2020.

As is also shown in Exhibit 4, ancillary revenues decreased considerably from 1999 to 2000 due to the abolition of duty free sales in July 1999. The ancillary business nowadays comprises of minor activities in retail outlets at the terminals, development activities at both ends of the tunnel and telecommunications as Eurotunnel continues the development of its fibre optic cable activity. It ceased its telecommunications operator business in 2000.

In 2001, major disturbances to the train schedules were caused by asylum seekers. In order to reach the United Kingdom, they were trying to gain illegal access to the tunnel system and freight trains. That year alone, 50,000 interceptions were made by the officials. The problem has now been solved by better surveillance. In addition, a nearby camp for asylum seekers in France, which served as a starting point, has been closed down.

Rail business has been subsidized by the rail usage contract for years, since revenues were protected by the minimum usage charge. That charge has been paid by the railways, as rail traffic has been far below expectations. In 2004, this protection amounted to £67 million out of total revenues of £234 million. By the end of November 2006 this provision expires, endangering even the current level of rail revenues. A crucial issue for improving rail capacity utilization is the pricing policy. According to Eurotunnel, due to its heavy debt burden it cannot risk to offer lower usage charges to railway operators.

Europorte 2, Eurotunnel's railway operating subsidiary, has obtained a Rail Operators Licence from the French authorities. That licence is valid for the international transportation of goods on the tracks belonging to the Trans-European Rail freight network.

Eurotunnel currently tries to improve its cash flow by the project DARE (Deliver Actions to Revitalise Eurotunnel). Steps to be taken within that project are for example reshaping the agreements with HGV hauliers, adjusting the capacity for freight shuttles accordingly, reducing the capacity for car shuttles and reviewing sub-contractor and supplier contracts.

## FINANCING FROM OPENING TO PRESENT

Failure to deliver forecasted results imposed financial constraints on Eurotunnel, for it was not able to meet the contractual interest and repayment schedule. Eurotunnel's Board decided to suspend interest payments on junior (subordinated) debt in September 1995 in order to renegotiate the capital structure under a standstill provision. The standstill, due to expire in May 1997, was extended by the lenders till December 1997. A restructuring plan was developed with the lenders leading for example to a major debt-equity-swap, reduction in interest rate risk exposure, postponement of interest payments and repayments. The extraordinary shareholder meeting in July 1997 approved the restructuring plan. The restructuring agreement was signed by the banks and Eurotunnel in January 1998. The main features of the debt-equity-swap were:

- Decrease of the amount of junior debt by exchanging part of it for new shares (£908 million).
- Exchange of junior debt partially for equity notes (£906 million), participating loan notes (£1,092 million) and a resettable facility (£1,366 million). Meanwhile, the equity notes have been exchanged into new units until the end of 2003. That – together with the debt-equity-swap – led to a dilution of the equity held by prior unitholders to 39.4%. The participating loan notes and the resettable facility postponed the repayment to 2040 and 2050 respectively (see Exhibit 7 for details).

Not as a part of the restructuring agreement, however linked to the critical financial condition of the project, the French and British government approved an extension of the concession period to 2086 in July 1997. That prolongation is to be paid for by a total annual sum, including corporate taxes, equal to 59% of the Group's pre-tax profits from 2052 on.[7]
After the completion of the financial restructuring Eurotunnel's debt has been trading in the secondary debt market at considerable discounts to its face value. As Eurotunnel's management puts it: 'Purchasing debt at such discounts continues to present an attractive opportunity to reduce the Group's indebtedness and interest obligations and to accelerate its financial recovery'.[8] Thus, Eurotunnel bought back debt with a face value of around £360 million in 1999. In order to finance further repurchases of about £150 million, the group issued new shares in October 1999. The repurchases were made at prices ranging from 26% to 52% of face value.

In 2000 and 2001 minor amounts of debt were repurchased at the market and so called stabilisation advances and deferred interest accounts were built up for interest which was not covered by cash generated. Postponement of interest payments amounted to £83 million in 2001.

A large portion of the equity notes mentioned above were converted into shares (units) in 2002. With the proceeds from an issue of £740 million of bonds (called Tier 1A), Eurotunnel bought back £840 million of debt at an average price of 43% of face value and refinanced £343 million of its junior debt.

The last equity notes were converted into units in 2003. Additionally, £155 million of debt were settled at a discount of about 58% of face value.

The company experienced a shareholder revolt which led to a change in management during spring 2004. The mainly French shareholders (see Figure 3) urged the governments to provide financial support for Eurotunnel. The governments declined that request referring to Article 1 of the Treaty between France and the UK and Clause 2 of the Concession Agreement (see Exhibit 1a and 1b). And finally, it became obvious during 2004 that the beginning of repayments in 2006/2007 will become a major problem for Eurotunnel as its operating cash flows are still not covering its interest obligations. This problem will become even more severe from 2006 onwards, when the stabilisation period ends and interest which cannot be paid in cash cannot be settled by using stabilisation advances anymore. Figure 4 and Exhibit 6 summarize the development of the capital structure. At the end of 2004 total loans outstanding amounted to £6.354 billion. Total financial charges of £331 million exceeded the net operating cash flow of £283 million (see Exhibit 5). A major restructuring effort is necessary again.

[7] See Eurotunnel, Annual Report 1997, p. 60.

[8] See Eurotunnel, Rights Issue Prospectus 1999, p. 1.

## ON THE EDGE OF INSOLVENCY

On 5 April 2005, Eurotunnel requested an exemption of the covenants in the Credit Agreement from its creditors. Two weeks later, senior debt holders and co-financiers gave Eurotunnel the waiver to the Credit Agreement enabling it to start renegotiations. During the presentation of the preliminary results for 2004 Eurotunnel estimated that the maximum amount the group could bear was somewhere between £2.3 billion to £2.7 billion.[9] They expect the lenders to write off the remainder. A representative of the Ad-hoc Credit Committee (see below), responded that 'Eurotunnel's suggestion will not be acceptable to the majority of debtholders, whose support is necessary for any capital restructuring. We look forward to starting negotiations within the framework of Eurotunnel's existing obligations and in the spirit of economic realism'. The annual general meetings in France and the UK once again confirmed that shareholders and management, represented by the chairman of the joint board, Jacques Gournon, favour a write-off.

The Ad-hoc Credit Committee consists of MBIA (an US credit insurer), the European Investment Bank, Franklin Mutual Advisers LLC. and Oaktree Capital Management. It represents 15% of senior debt and 69% of junior debt, the 4th Tranche Debt and the Tier 1A Debt. Looking back to the restructuring in 1997, one possible option from the lenders' point of view is a debt-equity-swap, which will lead to further dilution for the existing shareholders and would have to be approved by an extraordinary general meeting. The Concession Agreement also grants the right of substitution to the lenders (see Exhibit 1b). That right allows the lenders to substitute the current concessionaires, the Eurotunnel group, with new concessionaires, if Eurotunnel fails to make the payments required by the financing agreements for example. Assets owned by the Eurotunnel group are used as collaterals for different tiers of its debt. The Credit Agreement defines events of default which allow the lenders to demand early repayment (see Exhibit 7). Thus, lenders could send Eurotunnel into bankruptcy, use their right of substitution or use their collaterals.

One could argue that either the outcome of a legal bankruptcy procedure or using the right of substitution would not alter much of the core business of a fixed link operator. The crucial question remains to be answered: how much cash flow can be generated by Eurotunnel in the future? Can Eurotunnel be seen as a going concern company?[10]

## VALUATION

A valuation of Eurotunnel is necessary. While this is currently done confidentially within the company and the Ad-Hoc-Credit Committee, it can also be done from an external perspective. Due to the unique character of the Eurotunnel project, it is probably not possible to find peer companies for using comparable financial figures to evaluate Eurotunnel. For an

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[9] See Fitch Ratings, Eurotunnel and Related FLF1 & FLF2 Debt Vehicles – How Far Underwater Are They?, May 2005.

[10] That question is also being asked by the auditors in the preliminary annual report for 2004. Their answer is: yes, if financial restructuring is successful.

external valuation key value drivers have to be estimated. The main drivers for Eurotunnel's cash flows are the growth rates for its existing shuttle, rail and ancillary business, operational efficiency and the ability to create new and profitable business. For doing a valuation one might look into past growth rates of Eurotunnel, at the ratio of operating costs to revenues and the relation of capital expenditures to revenues. One could use other growth assumptions related to the growth of the GDP of Europe or its inflation rates or traffic projections. Due to its currently minor relevance, it is doubtful that ancillary revenues will cover much of the debt employed.

Since the present value of future cash flows is a crucial ingredient for valuing the position of owners and lenders, the APV (Adjusted-Present-Value) approach is helpful. This DCF method separates the value of operations from the value of tax shields caused by debt financing. The company has used 7.2% as a (unlevered) cost of equity fairly for accounting impairment tests recently. The average of the long-term risk free rate of returns in France and the UK is 4.15% at the beginning of 2005. The combined corporate tax rate is 33%. According to the latest annual report, tax loss carry forwards are estimated to be £3,081 million.

## Exhibit 1a: Treaty (Article 1)

Treaty between the United Kingdom of Great Britain and Northern Ireland and the French Republic concerning the Construction and Operation by Private Concessionaires of a Channel Fixed Link (12 February 1986)

*Article 1: Object and Definitions*
(1) The High Contracting Parties undertake to permit the construction and operation by private concessionaires (hereinafter referred to as "the Concessionaires") of a Channel fixed link in accordance with the provisions of this Treaty, of its supplementary Protocols and arrangements and of a concession between the two Governments and the Concessionaires (hereinafter referred to as "the Concession"). The Channel fixed link shall be financed without recourse to government funds or to government guarantees of a financial or commercial nature.

## Exhibit 1b: Concession Agreement (Clause 2, 32, 34)

*Clause 2: The Project and the Characteristics of the Fixed Link*
2.1 Subject to an in accordance with the provisions of this Agreement, the Concessionaires shall jointly and severally have the right and the obligation to carry out the development, financing, construction and operation during the Concession Period of a Fixed Link under the English Channel between the Department of the Pas-de-Calais in France and the County of Kent in England. Subject as aforesaid, they shall do this at their own risk, without recourse to government funds or to government guarantees of a financial or commercial nature and regardless of whatever hazards may be encountered. The Principals shall, in a manner which they will endeavour to co-ordinate between them, adopt such legislative and regulatory measures, and take such steps, including approaches to international organisations, as are necessary for the development, financing, construction and operation of the Fixed Link in accordance with this Agreement and ensure that the Concessionaires are free, within the framework of national and Community laws, to determine and carry out their commercial policy.

*Clause 32: Provisions relating to Lenders*
32.1 Substitution
32.1 (1) The parties to this Agreement agree that new Concessionaires shall be substituted for the initial Concessionaires in the following circumstances:
(a) following the occurrence of one of the events referred to in Annex IV and so long as its effect shall be continuing or if the Principals take or propose to take any action which could result in the premature termination of the Concession Period, two legal entities, one French and the other English (the "Substituted Entities") controlled by the lenders financing the construction and operation of the Fixed Link (the "Lenders")

shall, at the option of the Lenders and on the following terms, be simultaneously substituted by the Principals for the initial Concessionaires; and

(b) the Substituted Entities will need to provide evidence to the Principals that they have, at the time of substitution, a financial and technical capability sufficient to perform the obligations of the Concessionaires under this Agreement.

32.1(3) As from the actual or deemed confirmation of the substitution by the Principals, the Substituted Entities will benefit from all the rights and will assume all the obligations to the Principals under this Agreement and any leases granted to the initial Concessionaires pursuant to Annex II in place of the initial Concessionaires.

32.2 New Concession:

32.2(2) If the lenders have not exercised the right of substitution referred to in Clause 32.1(1) or, having been offered a new concession pursuant to Clause 32.2(1) (a), have not accepted the same or if the Substituted Entities have failed to fulfil the conditions specified in Clause 32.1(1) (b), if the Principals grant a new concession, the new concession agreement shall provide that the Lenders shall be entitled to receive from the new concessionaires payments out of the net revenues generated from such new concession in or towards repayment of the amounts owed to them on a subordinated basis agreed between the Lenders and such new concessionaires

32.2(3) If the Substituted Entities become the new concessionaires pursuant to Clause 32.2(1) (a), the new concession agreement will contain provisions to the effect that upon the payment of all amounts of principal, interest and other moneys from time to time owed to the Lenders under their financing agreements, it shall terminate without penalty.

*Clause 34: Exclusivity and Second Link*

34.1 The Concessionaires recognise that, in due course, the construction of a drive through link may become technically and financially viable. They undertake as a result to present to the Principals between now and the year 2000 a proposal for a drive through link which shall be added to the first link when technical and economic conditions for realisation of such a link shall permit it and the increase of traffic shall justify it without undermining the expected return on the first link.

34.2 The Principals undertake not to facilitate the construction of another fixed link whose operation would commence before the end of 2020. However, after 2010, and in the absence of agreement with the Concessionaires on the implementation of their proposal for the construction of a drive through link and as to its timetable, the Principals shall be free to issue a general invitation for the construction and operation of such a link. This new link shall not enter into operation before the end of 2020.

34.3 The Principals agree that throughout the Concession Period no link shall be financed with the support of public funds, either directly or by the provision of government guarantees of a financial or commercial nature.

*Annex IV to the Concession Agreement*

Events giving rise to the Right of Substitution

(1) failure to make any payment required under the financing agreements within a stated grace period;

(2) it appears, by reference to an objective test, that the Concessionaires do not have available and are not in a position to obtain sufficient funds to meet the estimated cost of construction or operation of the Fixed Link, together with the associated financing costs;

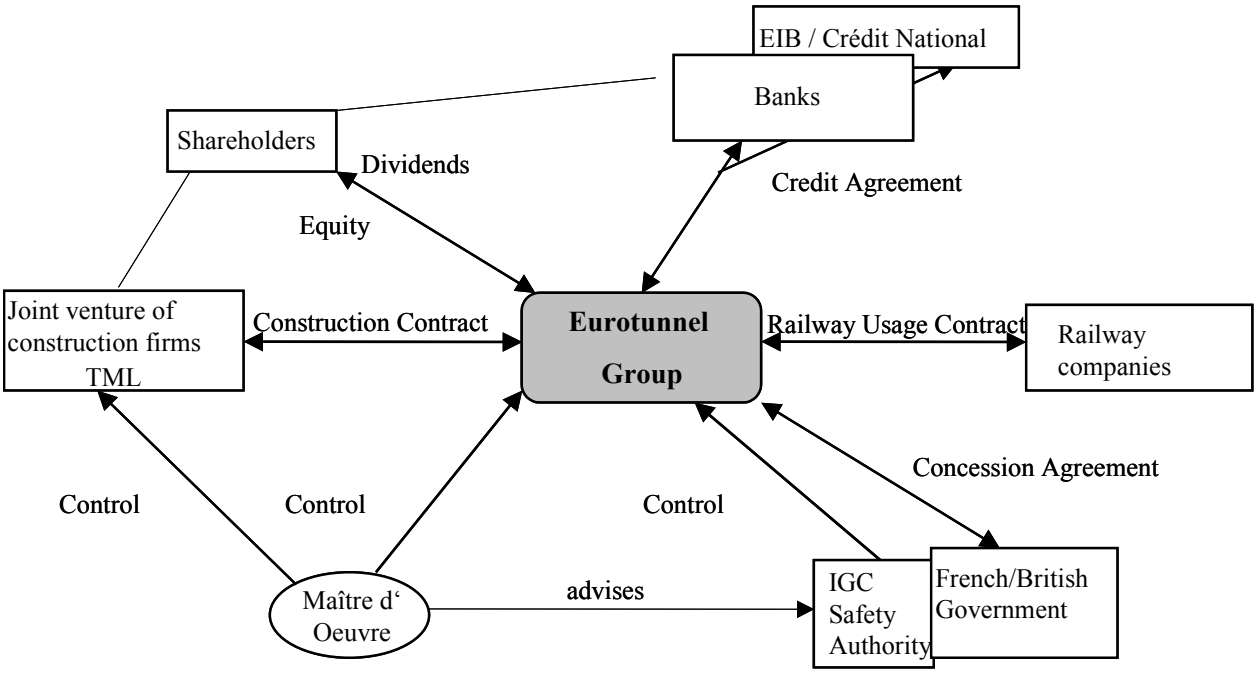
(3) it appears, by reference to an objective test, that the estimated final maturity date for repayment of the Lenders financing the construction and operation of the Fixed Link will be materially extended; or

(4) abandonment of the Project, insolvency, liquidation, enforcement of security by other creditors and related events.

## Exhibit 2: Project Structure

*Eurotunnel: Founding companies*

| | Channel Tunnel Group Limited | France Manche S.A. |
|---|---|---|
| *Banks:* | Midland Bank PLC | Banque Indosuez |
| | National Westminster | Banque Nationale de Paris |
| | | Crédit Lyonnais |
| *Construction companies:* | Balfour Beatty Construction Ltd. | Bouygues S.A |
| | Costain UK Ltd. | Dumez S.A. |
| | Tarmac Construction Ltd. | Société Auxiliaire d´Entreprises S.A. |
| | Taylor Woodrow Construction Ltd | Société Générale d´Entreprises S.A. |
| | George Wimpey International Ltd | Spie Batignolles S.A. |




**Maitre d'Oeuvre**: appointed by the concessionaires (if not objected by IGC) to review the work carried out regarding the relevant specifications, regulations, standards, contracts, timetable, and cost projections.

**IGC**: Intergovernmental Commission; supervises, in name and on behalf of the two governments, all matters concerning the construction and operation of the fixed link.

**Safety Authority**: advises and assists the IGC on all matters concerning safety in the construction and operation of the fixed link.

## Exhibit 3a: Cost until Opening

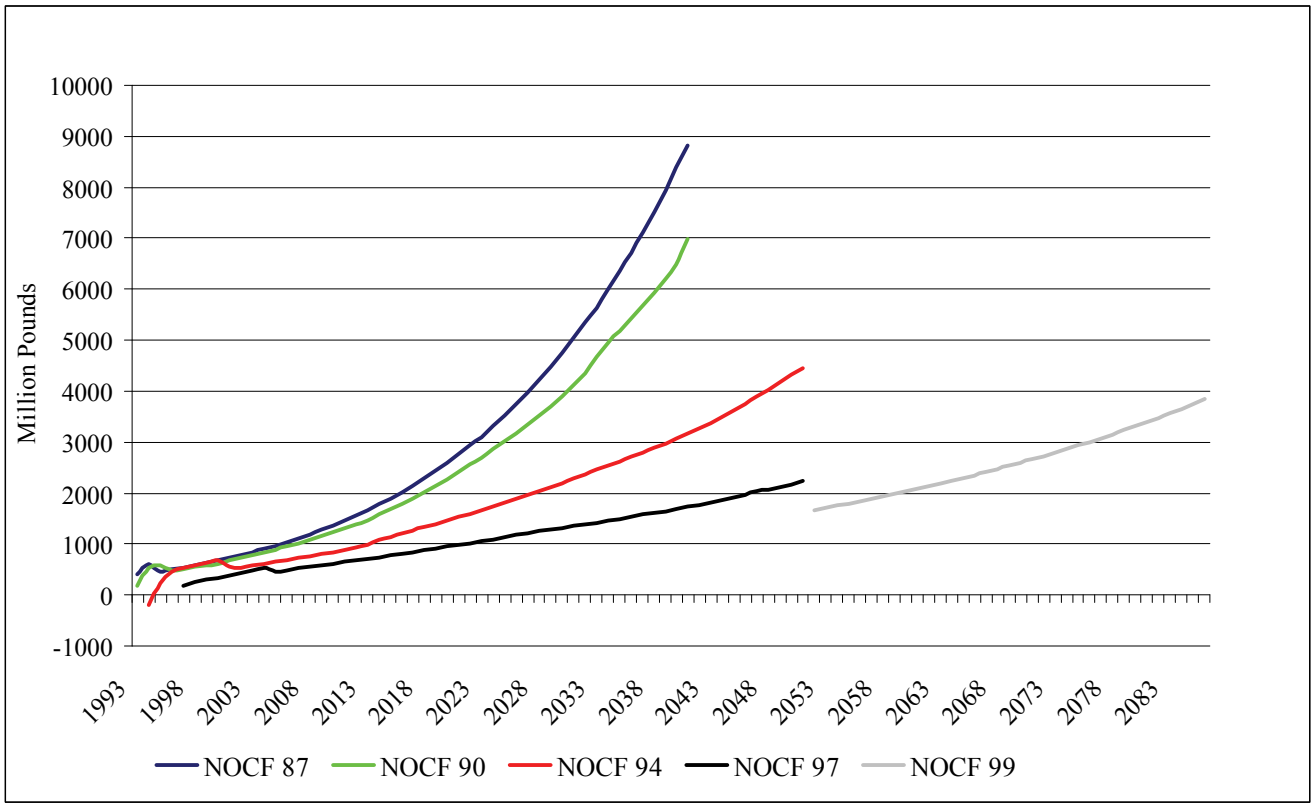
| £ million | Nov. 1987 | Nov. 1990 | Oct. 1991 | May 1994 |
|---|---|---|---|---|
| Target works (e.g. tunnels) | 1,367 | 2,009 | 2,009 | 2,110 |
| Lump sum works (e.g. buildings) | 1,169 | 1,305 | 1,305 | 1,753 |
| Procurement items (e.g. shuttles) | 252 | 583 | 692 | 705 |
| Bonus TML | | 72 | 72 | 46 |
| Direct works | | | | 36 |
| Project contingency | | 239 | 239 | |
| Total construction costs | 2,788 | 4,208 | 4,317 | 4,650 |
| Corporate costs | 642 | 787 | 829 | 1,128 |
| Provision for inflation | 469 | 1,031 | 1,031 | 1,146 |
| Net financing costs | 975 | 1,386 | 1,534 | 4,757 |
| Capital Expenditure | | | | 222 |
| Transfer to interest reserve | | | | 72 |
| Net Cash Out Flow at the Beginning of Operations | | 196 | 343 | -1,859 |
| Total | 4,874 | 7,608 | 8,054 | 10,116 |

## Exhibit 3b: Financing until Opening

| | £ million |
|---|---|
| Equity 1 | 46 |
| Equity 2 | 206 |
| IPO | 770 |
| Capital increase Nov. 90 | 568 |
| Capital increase 1994 | 858 |
| Warrants*) | approx. 200 |
| Total equity | 2,648 |
| Initial Credit Agreement | 4,985 |
| Revised Credit Agreement | 1,800 |
| EIB Credit Agreement | 300 |
| ECSC Credit Agreement | 200 |
| Senior debt | 647 |
| Interest guarantees | -29 |
| Total debt | 7,903 |
| Total funds | 10,551 |

* Consists of several issues; the largest of them in terms of funds raised were granted to shareholders at the IPO; however, until the expiration date (November 1992) only 2.7% of those warrants have been exercised.

## Figure 2: Management's Cash Flow Forecast




NOCF: Net Operating Cash Flow = Revenues – Operating Costs – Taxes – Change in Working Capital

Data taken from forecasts published at IPO 1987, SEOs 1990 and 1994, Financial Restructuring 1997.

NOCF 99 is based on the forecasted cash flow published for the financial restructuring 1997, but interpolated for the extended concession period (until 2086). The operating cash flows are decreased by 59% (agreement with the government) from 2052 onwards.

## Exhibit 4: Actual Key Figures

| **£ million** | **1996** | **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** |
|---|---|---|---|---|---|---|---|---|---|
| Shuttle | 145 | 113 | 210 | 270 | 314 | 309 | 333 | 309 | 285 |
| Rail | 198 | 212 | 213 | 215 | 208 | 211 | 217 | 232 | 234 |
| Ancillary | 105 | 132 | 196 | 141 | 57 | 27 | 20 | 25 | 19 |
| Revenues | 448 | 456 | 618 | 627 | 579 | 548 | 570 | 566 | 538 |
| Staff | 88 | 86 | 92 | 95 | 95 | 95 | 102 | 105 | 104 |
| Other operating expenses | 265 | 235 | 240 | 207 | 159 | 146 | 144 | 162 | 157 |
| Operating Cost | 353 | 321 | 332 | 302 | 254 | 241 | 246 | 267 | 261 |
| Capex | 44 | 37 | 57 | 59 | 71 | 82 | 41 | 25 | 19 |
| NOCF | 115 | 201 | 356 | 315 | 328 | 320 | 348 | 314 | 283 |

## Exhibit 5: Eurotunnel Group Financial Statements 2003/2004

### Balance sheet

| £'000 | 2004 | 2003 |
|---|---|---|
| Tangible fixed assets | 6,933,599 | 7,426,858 |
| Financial fixed assets | 18,910 | 17,205 |
| Total fixed assets | 6,952,509 | 7,444,063 |
| Total current assets*) | 423,106 | 823,022 |
| Prepaid expenses | 36,545 | 52,592 |
| Total assets | 7,412,160 | 8,319,677 |
| Shareholders' funds and liabilities | | |
| Total shareholders' funds | 528,241 | 1,099,187 |
| Provisions | 144,752 | 99,508 |
| Total creditors | 6,725,456 | 7,098,298 |
| Deferred income | 13,711 | 22,684 |
| Total shareholders' funds and liabilities | 7,412,160 | 8,319,677 |

* Including £181 million in cash and cash equivalent investments (2004).

### Profit and loss account

| £'000 | 2004 | 2003 |
|---|---|---|
| Total turnover | 555,173 | 583,944 |
| Total operating expenditure | 383,883 | 414,160 |
| *Operating profit* | 171,290 | 169,784 |
| Total financial income | 32,964 | 43,005 |
| Total financial charges*) | 331,158 | 362,143 |
| *Financial result* | (298,194) | (319,138) |
| Exceptional result**) | (442,806) | (1,184,847) |
| *Taxation* | 23 | 24 |
| Loss for the year | (569,733) | (1,334,225) |

* Including interest on leasing operations of £27 million; financial charges after leasing are £304 million
** Including an exceptional impairment of £ 395 million in 2004 (2003: £ 1,300 million).

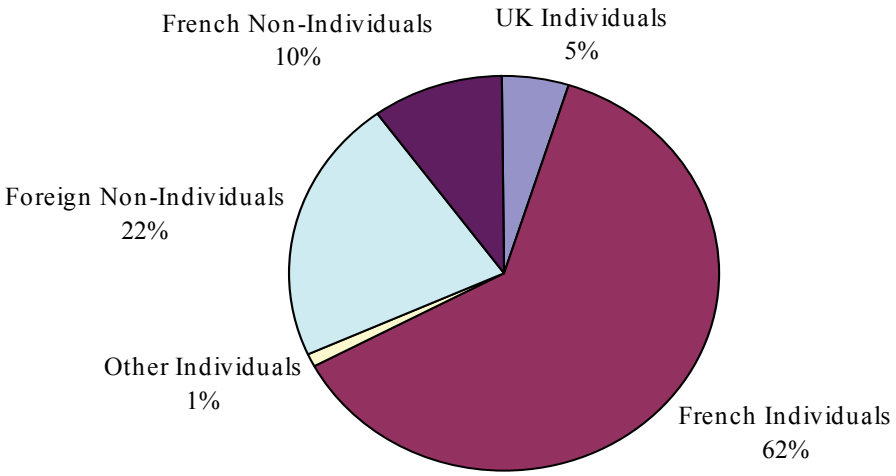
### Cash flow statement

| £'000 | 2004 | 2003 |
|---|---|---|
| Net cash inflow from operating activities | 283,312 | 314,304 |
| Returns on investments and servicing of finance | (281,241) | (277,878) |
| Capital expenditure | (18,934) | (24,717) |
| Other non-operating cash flows and taxation | (13,859) | 20,367 |
| Cash (outflow)/inflow before financing | (30,722) | 32,076 |
| Financing | 724) | (68,100) |
| Decrease in cash in the period | (31,446) | (36,024) |

## Figure 3: Shareholder Structure & Share Price

Number of Units at December, 31st 2004: 2,546,114,213

Share Price at December, 31st 2004: 17 Pence



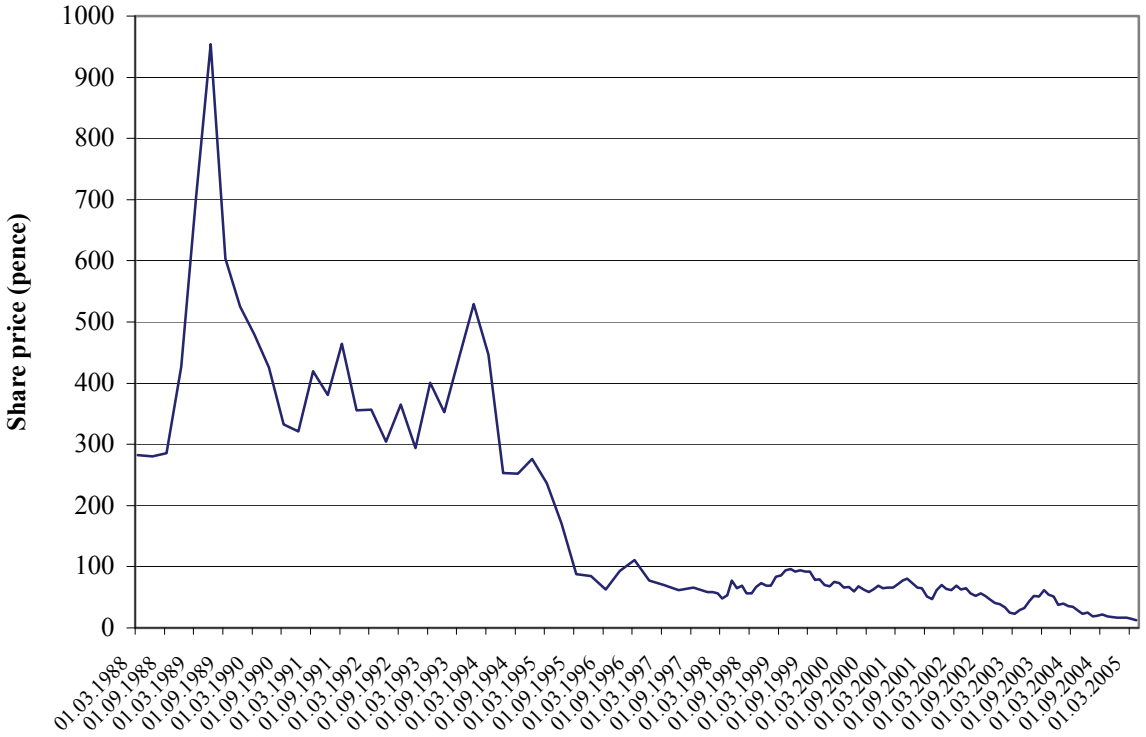
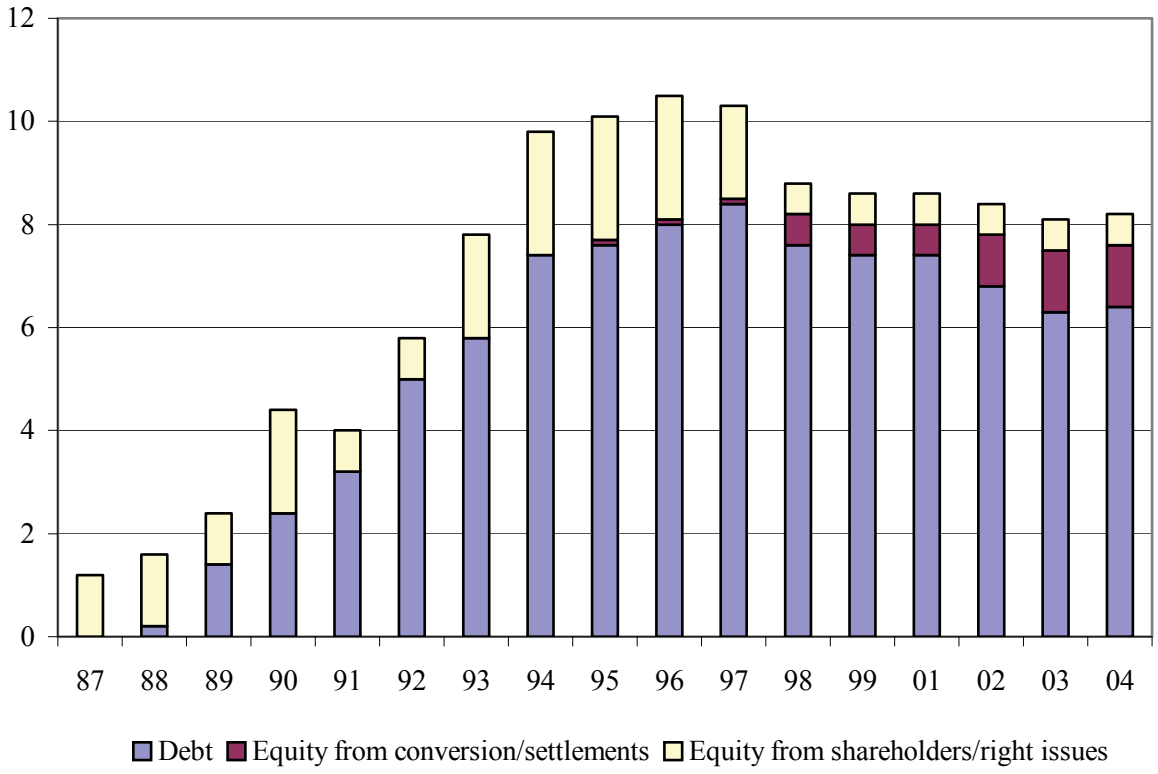



**Figure 4: Capital Structure in Book Values**



## Exhibit 6: Debt Employed 1988 – 2004

| £ million | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loan Notes | | | | | | | | | | | | | | | | | |
| Equity Notes | | | | | | | | | | | 935.7 | 621.9 | 623.0 | 615.5 | 252.4 | | |
| Participating loan Notes | | | | | | | | | | 8.4 | 1,127 | 820.8 | 822.3 | 812.4 | 839.2 | 873.8 | 874.1 |
| Stabilisation Notes | | | | | | | | | | | | | | | 0.1 | 76.9 | 161.4 |
| Total Loan Note Principal | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.4 | 2,063 | 1,443 | 1,445 | 1,428 | 1,092 | 950.6 | 1,036 |
| Bank Loans | | | | | | | | | | | | | | | | | |
| EDL, Senior and 4th Tranche Debt | | | | | | | | | | | 374.4 | 352.3 | 352.9 | 348.9 | 359.8 | 374.0 | 374.1 |
| Tier 1A Debt | | | | | | | | | | | | | | | 740.0 | 740.0 | 740.0 |
| Junior Debt | | | | | | | | | | | 3,640 | 3,397 | 3,404 | 3,352 | 3,127 | 3,265 | 3,264 |
| Resettable Advances | | | | | | | | | | | 1,414 | 1,130 | 1,130 | 1,115 | 550.7 | 479.1 | 473.0 |
| Total Bank Loan Principal | 175 | 1,061 | 2,340 | 3,488 | 5,388 | 6,936 | 7,858 | 8,580 | 7,915 | 7,545 | 5,428 | 4,880 | 4,887 | 4,816 | 4,778 | 4,858 | 4,851 |
| Unpaid interest | | | | | | | | 307.6 | 735.1 | 1,172 | 477.8 | 508.4 | 575.4 | 653.4 | 495.9 | 431.5 | 368.9 |
| Stabilisation Advances | | | | | | | | | | | 403.8 | 431.6 | 470.7 | 522.5 | 344.2 | 352.2 | 368.9 |
| Deferred interest account | | | | | | | | | | | 74.0 | 76.9 | 104.7 | 130.9 | 151.6 | 79.3 | |
| Total Loans | 175 | 1,061 | 2,340 | 3,488 | 5,388 | 6,936 | 7,858 | 8,887 | 8,651 | 8,716 | 5,906 | 5,388 | 5,462 | 5,469 | 5,273 | 5,289 | 5,220 |
| Accrued interest | 2 | 25 | 54 | 64 | 115.5 | 125.5 | 156.0 | | 138.6 | 157.3 | 158.7 | 136.3 | 138.9 | 136.3 | 127.6 | 124.9 | 98.1 |
| Loan Notes | | | | | | | | | | | 20.0 | 13.4 | 13.4 | 13.2 | 6.3 | 6.5 | 1.5 |
| Loans | | | | | | | | | | | 138.8 | 122.9 | 125.4 | 123.1 | 121.3 | 118.4 | 96.6 |
| Overdrafts | 0.4 | 1 | 2 | 1 | 1.4 | 2.8 | 2.2 | 4.2 | 2.1 | 2.3 | 2.5 | 1.3 | 0.6 | 0.0 | 0.0 | | |
| Total | 176.8 | 1,087 | 2,396 | 3,553 | 5,505 | 7,064 | 8,016 | 8,892 | 8,791 | 8,884 | 8,130 | 6,969 | 7,047 | 7,034 | 6,493 | 6,365 | 6,354 |

## Exhibit 7: Credit Agreement – Repayment, Some Covenants and Events of Default

| Debt instrument | Repayment |
|---|---|
| Participating Loan Notes | 2040 at the latest |
| Stabilisation Notes | Conversion into units or repayment from 2018 till 2026 |
| EDL, Senior and 4th Tranche Debt | Senior Debt: 2009 – 2012; 4th Tranche Debt: 2006 - 2019 |
| Tier 1A Debt | 2026: £120 million; 2027-2028: £620 million |
| Junior Debt | 2007 - 2025 |
| Resettable Advances | Until 2050 |
| Stabilisation Advances | Conversion into units or repayment from 2018 till 2026 |
| Accrued Interest | 2005 |

The Credit Agreement contains a number of events of default. The consequences of an event of default are that, unless the event of default is waived and subject to a standstill being triggered under the provisions of the Agreement Among Lenders, the Banks may demand early repayment of their loans, enforce their security or seek to effect substitution.

The events of default include:

(a) failure to pay amounts due under the Credit Agreement;
(b) material breaches of other obligations under the Credit Agreement and other relevant documents, which remain unremedied;
(c) insolvency and related events in respect of members of the Owning Group (including the inability to pay debts as they fall due);
(d) cross-default with other agreements;
(e) the ratio of operating cash flow to debt service costs plus capital expenditure (i) is less than 1.0 for any year in the period from 2006 (or if the Stabilisation Period is ended early, the first calendar year after the end of the Stabilisation Period) to 2011 and (ii) is less than 1.2 for any year in the period from 2012 to 31 December 2025;
(f) the ratio of turnover plus other operating income less operating expenditure (after depreciation) to total interest service costs in less than 1.0 for any year in the period from January 2008 (or if the Stabilisation Period is ended early, the third calendar year after the end of the Stabilisation Period) to 2011 and 1.5 for any year from 2012 to 2025;
(g) the Borrowers fail to meet the default repayment schedule in respect of the Junior Debt or fail to meet the repayment schedule in respect of the Stabilisation Advances.

Dividend constraints

Following implementation of the Transaction the declaration or payment of a dividend by Eurotunnel will constitute an event of default, unless.

(a) the Stabilisation Period has ended;
(b) no event of default or potential event of default is subsisting which has not been waived by the Agents;
(c) in respect of any dividend declared or paid after the end of the Stabilisation Period but before 1 January 2006 (if the Stabilisation Period is ended early), Eurotunnel is on or ahead of the target outstanding profile in respect of the Junior Debt;
(d) in respect of any dividend declared or paid up to the end of 2006 only, Eurotunnel has made the payment due under the Target Repayment Schedule in January 2006 for any dividend declared or paid in the first half of 2006 and, in addition, the payment due under the Target Repayment Schedule in July 2006 for any dividend declared or paid in the second half of 2006;
(e) in respect of any dividend declared or paid up to the end of 2009 (or, if earlier, full repayment (including by way of refinancing) of all Junior Debt), Eurotunnel has aggregate cash balances after payment of the dividend and all debt service required to be paid up to the date such dividend is declared or paid, of at least £70 million; and

(f) in 2010 or any subsequent year, and if at such time FLF still holds any Junior Debt, Eurotunnel has repaid an additional amount of Junior Debt equal to 50 per cent. of the repayment last required under the default repayment schedule.

Sources: Eurotunnel, Annual Report 2004; Redemption of Equity Notes Prospectus, 2002.

# VALUING A SMALL BUSINESS: THE CASE OF AN INDEPENDENT RETAIL PHARMACY

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*This case illustrates the challenges of private business owners when they near retirement, that is, finding a purchaser who is willing to pay a fair market value for their business in a timely manner. Jack is a 62 year old pharmacist who wants to sell his pharmacy and retire. Three potential acquirers are interested in buying his pharmacy. They include Fagen Pharmacy, CVS Corporation, and Medicine Shoppe International (MSI). And some of the acquirers have given him methods they commonly use to value independent retail pharmacies. Jack needs help determining a fair market value for his pharmacy because he is uncertain as to the method that is most appropriate for his situation. Moreover, because of prior business experiences, Jack is concerned about receiving a fair market value. Jack is hiring you to help him determine a fair market value for his pharmacy and this case: (1) shows how valuation methods used in the pharmacy industry arrive at different values, (2) illustrates that arriving at a fair market value is subjective, and (3) helps you develop negotiating skills.*

## CASE BACKGROUND

Jack graduated from Butler University's College of Pharmacy in 1967. After graduating he worked as a pharmacist at various chain drug stores in and around Indianapolis, IN. Although he worked for chain drug stores early in his career it was always his dream to one-day own and operate a pharmacy. In 1973 Jack realized his dream when he and his wife, Karen, opened Cloverdale Drugs in Cloverdale, IN. Jack expanded his business in 1976 by moving to a new, larger building that doubled the square feet to 2,500, and provided better customer parking. After opening Cloverdale Drugs, Jack also opened two other pharmacies in surrounding towns that have since been sold. Jack is 62 years old and wants to retire.

Currently there are three potential acquirers for his business, Fagen Pharmacy, CVS Corporation, and Medicine Shoppe International (MSI). Fagen Pharmacy is a private corporation of chain drug stores headquartered in northwest Indiana and has 24 locations in northwest Indiana and the Chicago, IL, metropolitan area. Cloverdale, IN, is located in west central Indiana and is about 120 miles south of the southern most Fagen Pharmacy location.

MSI uses the franchise system and is a division of Cardinal Health Company (NYSE: CAH) headquartered in Dublin, OH. It has nearly 1,000 locations in the United States and nearly 300 locations in six different countries. Pharmacists interested in owning and operating their own pharmacy contact MSI, and MSI helps them acquire an existing pharmacy or helps the pharmacist choose a new location. Cloverdale, IN, is located about 30 miles from the closest MSI location in Bloomington, IN.

CVS (NYSE: CVS) is one of the largest chain drug store operations in the United States with approximately 5,375 locations and is headquartered in Woonsocket, RI. Cloverdale, IN, is located about 11 miles from the closest CVS location in Greencastle, IN.

Cloverdale, IN, is a small town of about 2,300 residents in west central Indiana and is approximately 45 miles west of Indianapolis, IN on interstate 70. Recently the Putman County Hospital built a new medical clinic in Cloverdale that houses a number of medical professionals providing various services. With the addition of the clinic, Cloverdale now has a total number of three medical professionals that can prescribe medications. Because of the small size of the town no other pharmacy is located in Cloverdale; however, a number of pharmacies are located in Greencastle.

Exhibit 1 shows prescription numbers and prescription dollar sales for Cloverdale Drugs. Both the number of prescriptions and dollar sales of prescriptions increase in each of the last two years.

Exhibit 1

This exhibit shows prescription numbers and dollar sales for Cloverdale Drugs.

| Variable | 2002 | 2003 | 2004 |
|---|---|---|---|
| Number of Prescriptions | | | |
| New Prescriptions | 18,856 | 19,147 | 20,435 |
| Refill Prescriptions | 29,492 | 30,976 | 31,693 |
| Total Prescriptions | 48,348 | 50,123 | 52,128 |
| Dollar Sales of Prescriptions | | | |
| New Prescriptions | $787,240 | $863,613 | $983,389 |
| Refill Prescriptions | $1,231,300 | $1,397,153 | $1,525,155 |
| Total Prescriptions | $2,018,540 | $2,260,766 | $2,508,544 |

## SELLER'S BACKGROUND

Jack has been thinking of selling his pharmacy for a number of years and has received a few offers in the past. However, he feels that these offers are well below fair market value. Jack has been in business for over 30 years but has never had any formal business training. Two examples of Jack's business experiences follow.

In 1996 he sold his pharmacy nursing home business to NCS Healthcare receiving one-half of the selling price in cash on the date of sell and a promise from NCS to receive the other half one-year later if NCS Healthcare was still providing pharmacy services to the nursing home. According to the nursing home, it received a reduction in the quality of service shortly after NCS purchased the business and quit using NCS within one year. Thus, Jack didn't receive the other half of the selling price.

Another business experience involves one of his other pharmacies. In this case, the land and building that Jack was leasing was being sold to a local savings bank that wanted to relocate from its downtown location on the town square to one on the highway going through town. This move would increase the banks visibility and give it room to grow. Jack was notified by the owner of the land and building on Friday afternoon that the bank was offering to buy the land and building, and that if he wanted to buy it he must come up with matching funds within 24 hours. With such short notice, he was not able to secure financing and the land and building were sold to the bank. Within a few years, Jack's original land and building lease, which the

bank now owned, expired. The bank offered a new lease that would triple his monthly payment. The new lease terms made it too costly for him to sign the lease. He subsequently sold his pharmacy business in 1986 to a pharmacist and friend who was working for him and had purchased land on the same highway just across the street. Because of these business experiences, and others, Jack is concerned about receiving a fair market value for his pharmacy.

## BUYERS' BACKGROUND

Fagen Pharmacy is looking to expand its business and feels that a store in Cloverdale could open up new opportunities. Furthermore, it is aware of a number of other successful independent pharmacies in the surrounding area that will probably want to sell within the next 5-10 years. Buying the store in Cloverdale will give Fagen Pharmacy a presence in a new geographical area and might help it secure other purchases in the future.

Exhibit 2 presents the methods that Fagen Pharmacy uses to value pharmacies. These methods are accounting based methods that use information from the financial statements. Most of the methods use factors to adjust the historical accounting information because market values are rarely equal to book values. No information is available to determine how Fagen arrived at these methods.

Exhibit 2
This exhibit shows the methods that Fagen Pharmacy uses in the valuation process.

| | Method | Formula |
|---|---|---|
| 1 | Sales Projection | 1/3 annual sales volume |
| 2 | Average Daily Sales | 100 times average daily sales |
| 3 | Sum of Components | Inventory + fixtures & equipment + accounts receivables +goodwill (the most recent years profits) + 10% of previous year's refill dollars |
| 4 | Summation of relevant factors | Net worth (from balance sheet) + net profit one year |
| 5 | Net Income | 2 times(net profit + owner's salary) + inventory |
| 6 | Assets | (2 times net profit)+ net worth |
| 7 | Owner's Equity | net worth times 1.5 |
| 8 | Net Profit | net profit times 7 |
| 9 | Owner's Cash Flow (when financial condition of business is excellent) | 4 times net profit + (current assets - liabilities) |
| 10 | Owner's Cash Flow Intangible (for a pharmacy in good financial condition) | 2.5 times net profit + (current assets + fixed assets - liabilities) |
| 11 | Average of methods | weighted average of *relevant* methods |

MSI states that they purchase independent retail pharmacies free and clear of all debt. This means that the pharmacy owner is responsible for paying off all liabilities. MSI also states that the pharmacy owner keeps all assets, except those assets specifically named in the purchase agreement. According to MSI the pharmacy owner collects accounts receivables, and keeps cash as well as other current assets, except inventory, because it is specifically named in the purchase agreement.

MSI uses an inventory plus premium to compute pharmacy values. Inventory is directly from the balance sheet and the premium is computed using various methods. The premium value is compensation for assets that are more difficult to value such as patient lists, customer lists, patient files, prescription files, supplies, intangible assets, computer system and software, phone system and business phone numbers, and equipment (e.g., furniture and fixtures).

Exhibit 3 presents the methods that MSI uses to value pharmacy premiums. MSI uses three methods to determine premiums, percent of sales, dollar per annual prescription, and net profit margin. MSI states that the average independent retail pharmacy premium is typically between 15 percent and 25 percent of sales and 2-4 times earnings. In addition, prescription files are usually valued between $6 and $12 per annual number of prescriptions.

Exhibit 3

This exhibit shows the three Medicine Shoppe International valuation methods.

| | Method | Low Value | High Value |
|---|---|---|---|
| 1 | Annual Sales | 15% | 25% |
| 2 | Prescription Multiple | $6 | $12 |
| 3 | Net Profit Margin | 2x | 4x |

Exhibit 4 shows some descriptive statistics for the independent retail pharmacy industry. According to MSI, the average independent retail pharmacy has revenue between $2.0 and $2.7 million, a gross margin between 20 percent and 22 percent, and a net profit margin between 3 percent and 6 percent.

Exhibit 4

This exhibit shows values supplied by Medicine Shoppe International for pharmacy sales and profitability. Gross Profit margin is gross profit divided by sales. Gross profit is sales minus cost of good sold. Net profit margin is net income divided by sales.

| Variable | Below average | Average | Above Average |
|---|---|---|---|
| Annual Sales | <$2 million | $2-$2.7 million | >$2.7 million |
| Gross Profit Margin | <20% | 20-22% | >22% |
| Net Profit Margin | <3% | 3-6% | >6% |

MSI states that if revenue is above $2.7 million, then it is more appropriate to use the premium computed with the 25 percent of sales figure. However, if revenue is below $2.0 million, then it is more appropriate to use the premium computed with the 15 percent of sales figure. MSI makes similar statements about the gross margin. If gross margin is above 22 percent, then it is more appropriate to use a higher premium value, and if it is below 20 percent, then it is more appropriate to use a lower premium value.

To compute the premium using net profit margin, MSI states that the pharmacy owner should: (1) compute net profit margin, (2) multiply the most recent level of sales by the net profit margin, and (3) multiply the result in (2) by 2 or 4. If the net profit margin is above 6 percent, then it is more appropriate to use the higher premium value computed with the multiplier of 4, and it if is below 3 percent, then it is more appropriate to use the lower premium value computed with the multiplier of 2.

CVS does not disclose the methods they use for valuation. However, it is a publicly traded corporation and information is available to help Jack determine how much they should pay for his pharmacy.

## RETAIL PHARMACY INDUSTRY

Prescription drug spending continues to increase in the United States. It has increased more than any other healthcare service, up to $140.6 billion dollars in 2001 and is expected to grow more than 290% by 2011. Basically, we are living longer, almost 80 years, and getting older, every day 6,000 people turn 65. The aging of America is generating an increasing demand for prescription drugs. Moreover, the federal government recently passed legislation adding prescription drug coverage to Medicare and this is projected to have a positive impact on the pharmacy industry as more people will now have access to prescription medication. Finally, pharmaceutical manufacturers continue to introduce new products that improve the quality and length of life.

One challenge of the retail pharmacy industry is the growth of mail order pharmacies that are operated by pharmacy benefit managers (PBM) (i.e., insurance companies). Mail order pharmacies allow customers to purchase up to a 90-day supply of their maintenance medication versus the traditional 30-day supply at retail pharmacies. In addition, some PBM require their customers to have their maintenance medication filled at their mail order facilities. The longer day supply allows customers to avoid paying additional co-payments, saving them money. Recently, a number of large retail pharmacies are successfully neutralizing this challenge by refusing to sign contracts with PBM that require patients to have their maintenance medications filled at mail order facilities. By forcing PBM to allow customers the choice of getting a 90-day supply at a retail or mail order pharmacy, retail pharmacies are better able to compete. Moreover, large retail outfits like CVS are offering their own PBM.

Another challenge of the retail pharmacy industry is the illegal importation of prescription medication. Due to differences in prescription drug prices between the United States and other countries, such as, Mexico and Canada, the illegal importation of prescription medication is increasing. This decreases revenue for U.S. based pharmacies and pharmaceutical manufacturers who give Mexico and Canada lower pricing. This challenge is unresolved.

## CLOVERDALE DRUGS

Cloverdale Drugs continues to be a growing business with good financial results despite many challenges of operating an independent retail pharmacy. Exhibit 5 presents recent income statement information on Cloverdale Drugs. For the most recent year, sales increased by 12% and the owners' salary increased by more than 49%. The increase in owners' salary reduced net income by 83%, however. The increase in the tax rate from 2003 to 2004 is a result of a tax loss carry-forward being applied to pre-tax income in 2003.

Exhibit 5
This exhibit shows the income statement for Cloverdale Drugs. The tax rate is tax divided by EBT.

| **Income Statement** | 2003 | 2004 |
|---|---|---|
| Operating Revenue: | | |
| Sales, Gross | $2,659,725 | $2,979,269 |
| Returns & Allowances | $0 | $0 |
| Sales, Net | $2,659,725 | $2,979,269 |
| Cost of Goods Sold | $2,048,773 | $2,360,317 |
| Gross Operating Profit | $610,952 | $618,952 |
| Other Revenue: | | |
| other income | $2,430 | $6,460 |
| interest income | $3,277 | $0 |
| rental income | $2,450 | $4,200 |
| | | |
| Expenses: | | |
| Wages of Owners | $173,600 | $259,615 |
| Wages of Employees | $86,170 | $81,781 |
| Repairs & Maintenance | $5,376 | $3,856 |
| Bad Debts | $0 | $0 |
| Rents | $9,262 | $9,262 |
| Taxes & licenses | $33,186 | $29,704 |
| Charitable Contributions | $4,841 | $2,845 |
| Advertising | $4,924 | $5,245 |
| Pension, profit-sharing plans | $28,109 | $38,149 |
| Other deductions | $143,050 | $172,745 |
| EBITDA | $130,591 | $26,410 |
| Depreciation | $4,805 | $804 |
| Amortization | $0 | $0 |
| EBIT | $125,786 | $25,606 |
| Interest Expense | $0 | $0 |
| EBT | $125,786 | $25,606 |
| Tax | $34,210 | $10,159 |
| Net Income | $91,576 | $15,447 |
| Dividend | 0 | $0 |
| Retained Earnings | $91,576 | $15,447 |
| | | |
| Tax Rate | 27.20% | 39.67% |

Exhibit 6 presents recent balance sheet information on Cloverdale Drugs. The balance sheet is strong. Cloverdale Drugs uses no short-term or long-term debt in the capital structure. Moreover, its liquidity position is healthy with a current and quick ratio of 5.13 and 3.1, respectively.

Exhibit 6
This exhibit shows the balance sheet for Cloverdale Drugs.

| Balance Sheet | 2002 | 2003 | 2004 |
|---|---|---|---|
| **Assets** | | | |
| Current Assets: | | | |
| Cash | $83,995 | $122,953 | $117,292 |
| Receivables, net | $89,517 | $153,395 | $98,197 |
| Inventory | $167,484 | $184,384 | $192,077 |
| Other current assets | $89,436 | $87,415 | $87,415 |
| Total Current Assets | $430,432 | $548,147 | $494,981 |
| Non-Current Assets: | | | |
| Loan to Owners | $47,696 | $61,096 | $66,096 |
| Investments | $15,000 | $15,000 | $15,000 |
| Property, Plant, & Equipment, Gross | $76,150 | $80,024 | $84,161 |
| accumulated depreciation | $72,155 | $76,959 | $77,763 |
| Property, Plant, & Equipment, Net | $3,995 | $3,065 | $6,398 |
| Land, net | $4,620 | $4,620 | $4,620 |
| Other non-current assets | $417 | $225 | $42,014 |
| Total Non-Current Assets | $71,728 | $84,006 | $134,128 |
| **Total Assets** | **$502,160** | **$632,153** | **$629,109** |
| **Liabilities** | | | |
| Current Liabilities: | | | |
| Accounts Payable | $38,917 | $51,547 | $48,097 |
| short-term debt | $0 | $0 | $0 |
| Other current liabilities | $37,703 | $63,490 | $48,449 |
| Total Current Liabilities | $76,620 | $115,037 | $96,546 |
| Non-Current Liabilities | | | |
| long-term debt | $0 | $0 | $0 |
| Other Non-current liabilities | $0 | $0 | $0 |
| Total Non-Current Liabilities | $0 | $0 | $0 |
| Total Liability | $76,620 | $115,037 | $96,546 |
| **Shareholder's Equity** | | | |
| Common Stock | $5,500 | $5,500 | $5,500 |
| Retained Earnings | $420,040 | $511,616 | $527,063 |
| Total Shareholder's Equity | $425,540 | $517,116 | $532,563 |
| **Total Liability & Shareholder's Equity** | **$502,160** | **$632,153** | **$629,109** |

Two challenges of independent retail pharmacies are mentioned above, mail order pharmacies and the illegal importation of prescription medication. Other challenges for an independent retail pharmacy include reimbursement rates from PBM, and competition from retail chain drug stores.

Although large retail chain drug stores are better able to negotiate with PBM on contracts, independent retail pharmacies have little or no bargaining power. Thus, independent retail pharmacies are usually confronted with contract terms that are non-negotiable. This results in lower reimbursement rates for independents that reduce gross profit margins. However, recent proposed federal legislation that is gaining support will allow pharmacies that do not have publicly traded stock to join together and negotiate contract terms with PBM (http://www.ncpanet.org). Moreover, chain retail drug stores are better able to negotiate contract terms with generic drug manufacturers. This lowers their cost of goods sold and increases their gross profit margin.

There are many challenges of owning an independent retail pharmacy and in the '90's the number of independent retail pharmacies decreased while the number of retail chain drug stores increased. Today, independents account for about 44% of the retail drug store market. Recently, however, the number of independent retail pharmacies is stabilizing and is showing increases in some years. According to the National Community Pharmacists Association (NCPA) a big reason for the increase in independent retail pharmacies is the growth of prescription sales that is caused by the aging population and new drugs.

## THE MEETING

Last week Jack called you and set-up an appointment to meet with you. At that meeting he gave you the valuation methods that Fagen Pharmacy and MSI use. In addition, during your discussion he told you some interesting information that might be helpful in obtaining a fair market value for his pharmacy. In particular he told you the following information.

1. Cloverdale Drugs receives deliveries Monday-Saturday, six days per week while most chain drug stores receive one delivery per week. This allows Jack to keep inventory levels low.
2. Cloverdale Drugs is closed on Sunday and the following holidays: New Year's Day, Memorial Day, July 4, Labor Day, Thanksgiving, and Christmas.
3. Because of differences between corporate and personal income tax rates, Jack's accountant has always recommended that Cloverdale Drugs show little or no profit. In some years the pharmacy shows an operating loss because Jack pays himself too much in salary and this causes pre-tax corporate income to become negative. This triggers a tax loss carry-forward.
4. Store fixtures & equipment are fully depreciated.

During the meeting you tell Jack that you have a valuation technique known as the Free Cash Flow method that might be helpful in arriving at a fair market value for his pharmacy and show him an exhibit containing the computations that you will perform to compute Cloverdale Drug's free cash flow. Exhibit 7 contains the formulas that you will use to compute a pharmacy value using the free cash flow method. During your meeting you determine that all of the current assets are needed for operations and that net PP&E is the only operating fixed asset. The other fixed assets are not needed to operate the pharmacy. For example, through your discussions with Jack you learn that he purchased land in Cloverdale after the building and land that he was leasing at his other pharmacy was sold to the local savings bank. He did this to protect himself from a similar event in Cloverdale, but the land isn't needed to operate the pharmacy.

Exhibit 7

This exhibit shows how to compute free cash flow for Cloverdale Drugs.

| Variable | Formula |
|---|---|
| Net Operating Profit After Tax (NOPAT) | EBIT*(1-Tax Rate) |
| Net Operating Working Capital (NOWC) | Current operating assets - Noninterest bearing current liabilities |
| Total Operating Capital | NOWC + Net operating fixed assets |
| Net Investment in Operating Capital | $\text{Total Operating Capital}_{yr=t}$ - $\text{Total Operating Capital}_{yr=t-1}$ |
| Free Cash Flow | NOPAT - Net Investment in Operating Capital |

## RESEARCH

After the meeting you study the Fagen Pharmacy and MSI valuation methods and perform some research. For comparison purposes you gather information on some pharmacies in Indiana that have sold within the last year. Exhibit 8 shows this information. It includes only those pharmacies that you believe are good comparisons. Moreover, you gather financial ratios on three publicly traded chain retail pharmacies for the last five years. You gather five years of information to discern any trends in the retail pharmacy industry. Exhibit 9 shows this information. You will use this information to supplement the valuation methods supplied by Fagen and MSI.

Exhibit 8

This exhibit shows the selling price of pharmacies in Indiana within the last year as well as a number of other financial variables.

| Number | Selling Price | Revenue | Net Profit | Furniture/Fixture Value | Inventory Value | Reason for Sale |
|---|---|---|---|---|---|---|
| 1 | $2,700,000 | $9,649,348 | $803,220 | $200,000 | $500,000 | Retirement |
| 2 | $500,000 | $2,389,168 | $516,395 | $15,000 | $134,000 | Retirement |
| 3 | $1,250,000 | $4,467,131 | $865,000 | $864,796 | $583,605 | Retirement |
| 4 | $1,450,000 | $5,010,567 | $619,807 | $250,000 | $420,000 | Retirement |
| 5 | $100,000 | $650,000 | $100,000 | $15,000 | $40,000 | Retirement |

Exhibit 9

This exhibit presents ratios for Walgreens (WAG), CVS (CVS), and Rite-Aid (RAD). Inventory turnover is sales divided by inventory. Days sales outstanding is accounts receivables divided by average sales per day. Total asset turnover is sales divided by total assets. Inventory turnover is sales divided by inventory. Gross profit margin is sales minus cost of goods sold divided by sales. Net profit margin is net income divided by sales. Basic earnings power is earnings before interest and taxes divided by total assets. Return on assets is net income divided by total assets. Return on equity is net income divided by total common equity. Price to earnings is the stock price per share divided by the earnings per share. Market to book is the stock price per share divided by the book value of equity per share. Price to sales is the stock price per share divided by the sales per share.

| Year | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| **Inventory Turnover** | | | | | |
| WAG | 7.49 | 7.07 | 7.87 | 7.73 | 7.92 |
| CVS | 5.65 | 5.68 | 6.02 | 6.62 | 5.61 |
| RAD | 5.55 | 5.94 | 6.71 | 7.20 | 7.47 |
| ***Industry Average*** | 6.12 | 5.97 | 6.60 | 6.72 | 7.00 |
| **Days Sales Outstanding** | | | | | |
| WAG | 10.58 | 11.83 | 12.15 | 11.43 | 11.38 |
| CVS | 14.98 | 15.86 | 15.39 | 18.53 | 21.05 |
| RAD | 18.80 | 12.66 | 14.00 | 13.29 | 14.73 |
| ***Industry Average*** | 14.79 | 13.45 | 13.84 | 14.98 | 16.21 |
| **Total Asset Turnover** | | | | | |
| WAG | 2.99 | 2.79 | 2.90 | 2.85 | 2.81 |
| CVS | 2.53 | 2.58 | 2.51 | 2.52 | 2.10 |
| RAD | 1.36 | 1.83 | 2.34 | 2.58 | 2.66 |
| ***Industry Average*** | 2.29 | 2.40 | 2.58 | 2.69 | 2.46 |
| **Gross Profit Margin** | | | | | |
| WAG | 28.16% | 27.79% | 27.59% | 28.13% | 28.26% |
| CVS | 26.69% | 25.59% | 25.10% | 25.81% | 26.06% |
| RAD | 25.29% | 25.69% | 24.77% | 25.17% | 25.88% |
| ***Industry Average*** | 38.63% | 38.78% | 38.71% | 39.38% | 26.74% |
| **Net Profit Margin** | | | | | |
| WAG | 3.66% | 3.60% | 3.55% | 3.62% | 3.63% |
| CVS | 3.71% | 1.86% | 2.96% | 3.19% | 3.00% |
| RAD | -7.60% | -9.86% | -5.02% | -0.80% | 0.50% |
| ***Industry Average*** | -0.07% | -1.47% | 0.50% | 2.00% | 2.38% |
| **Basic Earnings Power** | | | | | |
| WAG | 17.23% | 15.83% | 16.44% | 16.20% | 16.06% |
| CVS | 16.64% | 13.02% | 12.51% | 13.50% | 10.00% |
| RAD | -1.44% | 0.63% | 4.56% | 6.17% | 6.17% |
| ***Industry Average*** | 10.81% | 9.82% | 11.17% | 11.96% | 10.74% |
| **Return on Assets** | | | | | |
| WAG | 10.94% | 10.03% | 10.32% | 10.31% | 10.19% |
| CVS | 9.38% | 4.79% | 7.43% | 8.04% | 6.32% |
| RAD | -10.32% | -18.09% | -11.75% | -2.05% | 1.33% |
| ***Industry Average*** | 3.33% | -1.09% | 2.00% | 5.43% | 5.95% |
| **Return on Equity** | | | | | |
| WAG | 18.35% | 17.01% | 16.36% | 16.34% | 16.53% |
| CVS | 17.33% | 9.05% | 13.79% | 14.07% | 13.15% |
| RAD | -258.53% | 404.01% | -7928.13% | 111.93% | 895.70% |
| ***Industry Average*** | -74.28% | 143.35% | -2632.66% | 47.45% | 308.46% |
| **Price to Earnings** | | | | | |
| WAG | 39.53 | 37.85 | 33.76 | 25.47 | 27.19 |
| CVS | 22.04 | 32.66 | 16.20 | 17.22 | 39.54 |
| RAD | -1.61 | -1.01 | -1.99 | -7.74 | 50.73 |
| ***Industry Average*** | 19.99 | 23.16 | 15.99 | 11.65 | 39.15 |
| **Market to Book** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| WAG | 7.19 | 6.32 | 5.42 | 4.07 | 4.39 |
| CVS | 4.01 | 3.02 | 2.30 | 2.49 | 5.35 |
| RAD | 14.76 | -2.64 | -4.89 | -2.44 | -7.06 |
| ***Industry Average*** | 8.65 | 2.24 | 0.94 | 1.37 | 0.90 |
| **Price to Sales** | | | | | |
| WAG | 1.44 | 1.34 | 1.18 | 0.90 | 0.96 |
| CVS | 0.81 | 0.59 | 0.47 | 0.54 | 1.18 |
| RAD | 0.12 | 0.13 | 0.11 | 0.08 | 0.17 |
| ***Industry Average*** | 0.79 | 0.68 | 0.59 | 0.51 | 0.77 |

Finally, you discover that similar independent retail pharmacies with all equity capital structures have a 10 percent cost of capital and that these pharmacies typically have a constant growth of 5 percent in free cash flow. You will use this information to compute a pharmacy value using the free cash flow method.

## YOUR MISSION

You are a young investment banker who is gaining experience in the area of corporate asset valuation. Jack is hiring you to be his advocate and your mission is to: (1) help him put together a valuation report that will help him understand the fair market value of his pharmacy, (2) supply him with useful information that he can use during his negotiations, and (3) help him sell the pharmacy within a reasonable period for the highest possible price. In your report you should:

Computation Problems:

1. Compute pharmacy values using the methods supplied by Fagen Pharmacy.
2. Compute pharmacy values using the methods supplied by MSI. MSI's methods require you to make choices and this can result in a range of premium values. In these cases, you should compute a low and high premium.
3. Compute pharmacy values using the comparable information you gathered after meeting with Jack. First, compute a selling price to revenue (P/S) ratio for each of the comparables. Use each one of these ratios and the revenue from Cloverdale Drugs to compute a selling price for Cloverdale Drugs. Second, compute an equally weighted P/S ratio using the comparables and repeat the process. Next, compute a selling price to earnings ratio (P/E) for each of the comparables in exhibit 8. Use each one of these ratios and the earnings from Cloverdale Drugs to compute a selling price for Cloverdale Drugs. Finally, compute an equally weighted P/E ratio using the comparables and repeat the process.
4. Compute pharmacy values using the most recent P/S, P/E, and M/B ratio for CVS.
5. Compute a pharmacy value using the Free Cash Flow method using the most recent financial statement information.
6. Compute the following asset management ratios for Cloverdale Drugs: inventory turnover, total asset turnover, and days sales outstanding.
7. Compute the following profitability ratios for Cloverdale Drugs: gross profit margin, net profit margin, basic earnings power, return on assets, and return on equity.

Discussion Problems:

8. Discuss the valuation methods used by Fagen Pharmacy. In your discussion include the strengths and weaknesses of each method. Determine which methods you think are more or less appropriate. Specifically, if a particular method results in a higher valuation, then explain why this method is more appropriate. Conversely, if a particular method results in a lower valuation, then explain why this method is less appropriate.
9. Repeat problem 8 for MSI.
10. Discuss the comparables method.
11. Discuss the methods that use CVS ratios.
12. Compare the asset management ratios for Cloverdale Drugs to the asset management ratios for CVS, Walgreens, and Rite-Aid. Does Cloverdale Drugs seem to be a well managed business?
13. Compare the profitability ratios for Cloverdale Drugs to the profitability ratios for CVS, Walgreens, and Rite-Aid. Does Cloverdale Drugs seem to be a profitable business? What might be the cause of any changes in Cloverdale Drugs profitability?
14. Compare the 2004 net profit margin for CVS, Walgreens, and Rite-Aid to the average net profit margin of 3-6 percent supplied by MSI. Does the MSI figure seem appropriate? How might you use this information during negotiations?
15. Recommend a fair market value range for Cloverdale Drugs and support your recommendation.

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# INFLUENCE DIAGRAMS FOR REAL OPTIONS VALUATION: VALUING AGOURON PHARMACEUTICALS, INC.

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## ABSTRACT

This paper proposes the use of Influence Diagrams (ID) as effective tools to model and place values on investment opportunities consisting of options on real assets (real options). We present an ID model to value a biotechnology firm, Agouron Pharmaceuticals, Inc., in terms of the sum of the values of its drug development projects. We compare the computed values of Agouron to actual market values at selected points in time during the development of Viracept, a drug used to treat HIV-positive patients. The ID model yields better estimates of the share prices than the values found using a binomial-lattice representation with the addition of a growth option. Our findings suggest that managerial flexibility in projects can be modeled and valued correctly using the Net Present Value methodology within an ID model.

**Keywords**: Decision analysis: Applications, Risk; Finance: Capital budgets, Investment.

## INTRODUCTION

Real Options Analysis (ROA) has been proposed as an alternative methodology to evaluate capital investments such as R&D projects or new product decisions. The advantage of ROA is that unlike the Net Present Value (NPV) methodology used in capital budgeting, ROA treats a given investment opportunity as a single option or series of compound options, and thus captures asymmetric upside potentials embedded in the project. Well known texts like Trigeorgis (1996) and Dixit and Pindyck (1995) suggest that neither the discounted cash flow (DCF) approach nor the NPV framework can value correctly operational flexibility and other strategic aspects of investment projects because these rules make the false assumption that the investment is either irreversible or that it cannot be delayed. Similarly, Smith and McCardle (1999) criticize the cost-of-capital based discounting rule as the riskiness of the project in some cases may be significantly different than the firm's own risk structure.

With financial options, the initial investment in an options contract buys the potential opportunity to enjoy a positive cash flow in future propitious times, but does not carry the obligation to realize negative cash flow if adverse conditions prevail. This flexibility adds value to a financial option contract. With a real option—an option on a real asset—the initial investment in a project buys the potential opportunity to continue, expand, or abandon the project when it is advantageous to do so, but does not carry the obligation to realize some losses if the

project faces adversity. As with financial options, the value of a real option is sometimes assessed by constructing an abstract hedge portfolio composed of the flexible project (with the option), the underlying asset, and cash. The idea is that as long as one can construct a portfolio that replicates the cash flows from the flexible project, a no-arbitrage argument can be used to value the project as a function of the value of the underlying asset and the funds borrowed against it.

The effectiveness of the ROA method in estimating the true value of an investment project depends on how well uncertainty is represented in the model. Indeed, ROA is becoming popular among corporations, investors, and governments because this methodology factors uncertainty and managerial flexibility into final valuation much better than do existing valuation methods.

Recently, Lander and Shenoy (1999) proposed the use of influence diagrams for representing uncertainty and flexibility in order to value real options. An influence diagram (ID) is a graphical modeling tool for representing the underlying structure of a problem and depicting the decision-maker's current knowledge about the situation. One major advantage of IDs is that the graphical representation makes it easy to depict uncertainty and managerial flexibility. Thus, investment projects that include sequential decisions or projects that have an asymmetric structure due to managerial flexibility can be represented in a compact graphical manner, which can make it easier for decision-makers to understand complicated aspects of the problem. Further, because uncertainty in key underlying variables such as discount rates can be represented compactly within the ID framework, it is possible to use an NPV-based calculation for valuation instead of one that requires replicating portfolios and no-arbitrage arguments for illiquid assets, or certainty-equivalent probabilities that must be determined subjectively by the decision-maker.

The starting point of ROA is the suggestion that the traditional DCF and NPV methodologies are inadequate for evaluating projects containing embedded options, such as the option to expand, postpone, or abandon the project once it has begun. The traditional methods are based on the calculation of total value of projected cash flows discounted at a single discount rate that is selected on the basis of a subjective assessment of the riskiness of the project. A major problem with these methodologies is that they use a single discount rate for risky cash flows regardless of which conditioning scenario generates those cash flows. However, in most real-life investment projects, the flexibility embedded in future decisions changes the payoff structure and the risk characteristics of an actively managed asset, which in turn invalidates the use of a constant discount rate. Thus, the NPV and DCF methods fail to value scenario-dependent cash flows correctly when projects are subject to active management. However, in a recent study, De Reyck, Degreave and Vandedborre (2002) suggest that flexibility in projects can be valued correctly with a decision tree as long as different discount rates that prevail at different chance nodes are determined properly. Brealey and Myers (2000) raise a similar point and suggest dividing projects into segments where the same discount rate can be used reasonably. This segmentation is handled easily with an ID.

In this paper, we show how to use IDs as effective tools to represent decision flexibility and uncertainty inherent in investment projects. We build on Kellogg and Charnes (2000) valuation model of Agouron Pharmaceuticals, Inc. and construct an ID model to represent and solve the same problem. We estimate share prices for Agouron at selected points in time during the development of Viracept, a drug used to treat HIV-positive patients. We then compare our computed values to actual market values as well as to the decision-tree and binomial-lattice

estimates of Kellogg and Charnes (2000). We get better estimates of Agouron's stock price in 4 out of the 5 selected dates. With the exception of October 1994, the influence diagram improves the estimates by at least 10% in the worst case and by 32% in the best case. Our findings support the suggestion that the NPV-based methodology can be used effectively without relying on an analysis that requires the formulation of abstract hedge portfolios.

The outline of the paper is as follows. Section 2 provides brief information on Agouron Pharmaceuticals, Inc. and describes the risks inherent in new drug development. Section 3 outlines the assumptions made in the valuation of the project. Section 4 describes the decision tree, binomial lattice, and influence diagram valuations of Agouron. Section 5 presents the results obtained using the three methods and compares the values with actual share prices of Agouron. Finally, Section 6 provides concluding remarks and suggestions on future research.

## AGOURON PHARMACEUTICALS, INC.

Agouron was founded in 1984 and became a publicly traded company in 1987. Until 1997 the company had no operating income from products and most of its efforts focused on the discovery of new molecular entities (NMEs) and clinical trials thereof. Agouron also formed partnerships with larger pharmaceutical companies to collaborate on the discovery, development and commercialization of drugs based on biotechnology.

Such partnerships are common in the pharmaceutical industry. For the biotech companies, the partnerships provide credibility, capital, additional technical expertise and the means to market their products in many areas of the world where the larger company has established operations. For the larger pharmaceutical companies, the biotech companies provide additional sources of innovative ideas and become an extension of their existing R&D group. In a typical partnership the larger company acquires equity in the biotech company, and provides payments to the biotech company upon the initiation of a specified phase of development or governmental approval. The companies then share the resulting cash flows of the approved drug.

In July 1994, Agouron was conducting research on anti-cancer and anti-HIV compounds. It had two anti-cancer NMEs in Phase I clinical trials, and one anti-HIV NME in pre-clinical development. During the next four-and-one-half years, Agouron made several major announcements about the progress of its research and development. On January 26, 1999, Agouron announced that it was being acquired by Warner Lambert Co. for stock valued at $US 2.1 billion.

### New Drug Development

Valuation of pharmaceutical companies that are in the development phase for new drugs is a challenging task. Investment projects involving new drugs are costly and highly risky. Of the virtually infinite number of molecular compounds that may have pharmacological effect, drug companies must choose carefully the compounds in which to invest the millions of dollars in development costs required to launch a new product on the market. The development process is composed of several stages, during which the drug company gathers evidence to convince government regulators that it can consistently manufacture a safe and efficacious form of the compound for the medical condition it is intended to treat. At the end of each stage, the firm uses the technological and market information revealed up to that point to decide whether to abandon

or continue development of the compound.

Drugs that reach the market in the United States typically pass through the following stages:

**Discovery**. In this stage, a significant amount of effort is expended by chemists and biologists to develop concepts for synthesizing NMEs. Many NMEs are abandoned at this stage.

**Pre-clinical**. The NME is screened for pharmacologic activity and toxicity *i*n *vitro*, and then in animals. If the NME is a promising candidate for further development, the firm will file with the Food and Drug Administration (FDA) an Investigational New Drug (IND) application. An approved IND allows the firm to continue development by testing the drug on humans in clinical trials. Clinical trials are generally broken down into three phases.

**Phase I clinical trials**. Testing is conducted in a small number of (usually healthy) volunteers to obtain information on toxicity and safe dosing ranges in humans. Data are also collected on the drug's absorption and distribution within the body, the drug's metabolic effects, and the rate and manner in which the drug is eliminated from the body.

**Phase II clinical trials**. The drug is administered to a larger number of individuals selected from patients for whom the drug is intended to benefit. Successful Phase II trials provide significant evidence of efficacy, and additional data on safety.

**Phase III clinical trials**. This final pre-marketing clinical development phase involves large-scale trials on patients to obtain additional evidence of efficacy. Larger sample sizes increase the likelihood that actual benefits will be found statistically significant, and that adverse reactions occurring infrequently in patient populations will be observed. Phase III trials are designed to approximate closely the manner in which the drug will be utilized after marketing approval.

**FDA filing and review**. After the clinical development phases have been completed and the firm believes it has sufficient evidence for approval, it will submit a New Drug Application (NDA) to the FDA for review. Marketing for approved uses may begin upon notification from the FDA.

**Post-approval**. While the firm receives revenues from the sales of its new drug, it conducts additional research to support marketing efforts and to develop extensions of the product. These extensions include alternate formulations and dosages for subsets of patients such as children.

## ASSUMPTIONS

In this paper, we compare the valuations obtained using an influence diagram with the valuations in Kellogg and Charnes (2000) obtained through the decision tree and binomial lattice methods. Therefore, we use many of the same assumptions they applied in their analysis. The assumptions about development costs, probabilities of success, and profitability of new drugs are based upon the work of Myers and Howe (1997), Office of Technology Assessment (1993), DiMasi, et al. (1991), and Grabowski and Vernon (1994). All costs and revenues are stated in 1994 constant dollars ($US 000s).

We assumed that a drug reaching the market will fall into one of five quality categories: (1) dog, (2) below average, (3) average, (4) above average, or (5) breakthrough. A marketed drug has a 60% probability of being of average quality and a 10% probability of being in each of the other four categories. The revenues associated with each quality category are highly skewed, with the peak revenue for dog and below average drugs being no more than $7.4 million per year

and that of breakthrough drugs being over $1.3 billion per year. The revenue for each category by year after launch is shown in Figure 1. Peak annual revenue by category is shown in Table 1.

Table 2 shows for each development stage the assumed pre-tax cost, duration in years, and probability of successful completion of that stage conditional on successful completion of the prior stages.

We assumed for R&D stages of duration greater than one year that total cost was allocated equally to each year. For some approved drugs, we assumed that post-approval clinical trials would be done. The purpose of these trials is to support the marketing effort for the drug. For example, the results of post-approval clinical trials are often cited in promotional literature that is presented to physicians by sales representatives. Without new information, it is often difficult for a sales representative to get the attention of a busy physician. For drugs with low sales (dog or below average), we assumed that revenues will be insufficient to warrant post-approval clinical trials.

As are most products, drugs are subject to a product life cycle. The peak period of a drug's life cycle occurs just prior to patent expiration. After the patent expires, competitors may sell generic versions of the compound, and the competition causes revenues to drop. Myers and Howe (1997) do not include revenues beyond the peak year, as the post-patent-expiration revenues were not relevant to their analysis. We based our assumptions regarding post-patent years on the Office of Technology (1993) report. Table 3 provides details for other cash flow assumptions.

## VALUATION METHODS

The efficient representation and solution of decision problems has always been a challenging task for academics and practitioners. Ideally, one is interested in models that are compact in representing different aspects of a decision problem as well as models that use efficient solution algorithms. In this section, we first present a brief discussion of the decision tree and binomial lattice valuations of Kellogg and Charnes (2000) and then provide the details of the influence diagram representation of the same project.

### Decision Tree Method

Traditionally, decision trees (DT) have been used for the representation and solution of decision problems. This representation has its origins in von Neumann and Morgenstern's (1953) extensive form games. It is a flexible, graphical representation in which all possible scenarios are depicted as paths within a tree structure. For Agouron Pharmaceuticals, the decision tree valuation is done by calculating the expected net present value (ENPV) of the drug without taking into account growth options. The ENPV is calculated as:

$$\text{ENPV} = \sum_{i=1}^{7} p_i \sum_{t=1}^{T} \frac{DCF_{it}}{(1+r_d)^t} + p_7 \sum_{j=1}^{5} q_j \sum_{t=1}^{T} \frac{CCF_{jt}}{(1+r_c)^t}$$

where i =1,...,7 is an index of the seven stages from discovery through post approval described in Section 2.1, $p_i$ is the conditional probability that stage i is the end stage for a drug that has reached stage i−1, T is the time at which all future cash flows become zero, $DCF_{it}$ is the expected

development stage cash flow at time tgiven that stage i is the end stage, $r_d$ is the discount rate for development cash flows, j =1,...,5 is an index of quality for the drug (defined in Section 3), $q_j$ is the probability that the drug is of quality j, $CCF_{jt}$ is the expected commercialization cash flow at time t for a drug of quality j, and $r_c$ is the discount rate for commercialization cash flows. This is represented graphically in Figure 2.

The use of different discount rates for development cash flows and commercialization cash flows follows Myers and Howe (1997), who based their selection of rates partly on Myers and Shyam-Sunder (1996). We used real rates of 6% and 9% for development cash flows and commercialization cash flows, respectively. The inflation estimate was obtained from the average GDP deflator index over the prior five years from the date for which the valuation was made. For example, in calculating the ENPV of an NME in 1994 the inflation estimate was 3.58% resulting in nominal rates of $r_d$ =9.8% and $r_c$ =12.9%.

Table 4 shows the ENPV calculation of a discovery phase NME in spreadsheet form. This is done by determining the present value of all the possible end points and calculating the sum product of the present values and their respective probabilities. The values of each of the firm's project ENPVs are adjusted according to the sharing agreements with partners, and are then summed and divided by the shares and warrants outstanding to obtain a per-share value for the firm. This spreadsheet is available from *www.siue.edu/~rdemire/ROA.htm*.

The decision tree framework has several advantages and disadvantages. For this particular problem, it is easy to construct and solve the tree because for any NME there will be no more than eleven potential end points. The fact that uncertainty is resolved at discrete points in time makes the decision tree framework quite practical. It is also easy to communicate using either tables or decision trees. This framework maps out all possible scenarios, and thus can model any possible path dependent cash flow pattern resulting from managerial flexibility. Finally, it incorporates the notion of an abandonment option as well as the potential of five scenarios of successful outcomes. However, the fact that all possible scenarios must be included in a DT leads to the combinatorial explosion of this representation, thus making DTs impractical for large scale projects. Consider a problem consisting of n decisions to be made and m uncertain outcomes to be observed at different stages of the problem. Even if we assume that each decision offers two possible choices and each uncertainty has two possible probabilistic outcomes, we come up with a decision tree consisting of $2^{m+n}$ end points. Considering real life decision problems where a decision maker is faced with more than two choices at each decision (or more than two possible outcomes for each uncertainty), DT representation may be unwieldy for large-scale problems. In addition, the DT framework, as solved in Kellogg and Charnes (2000) does not model volatility in the best way. Their use of discount rates applicable to commercial and non-commercial cash flows ignores the effect of managerial flexibility on the volatility of scenario dependent cash flows. This is, however, a problem common to all methods since the presence of an option makes it difficult to determine the appropriate discount rate applicable to different subtrees in a DT. However, as DeReyck et al (2002) suggest, this problem is resolved if the discount rates that prevail at different chance nodes are properly determined. In Section 4.3, we show that a simple modification within the influence diagram framework leads to better solutions than those obtained by the decision tree and binomial lattice methods.

**Binomial Lattice Valuation**

The solution algorithm for the binomial lattice method is based on the discrete-time binomial option pricing technique that was originally developed to value financial options (see Cox, Ross and Rubinstein, 1979). Starting in the 1980s, modifications of this method (and also its continuoustime version) have been used to value real options (Brennan and Schwartz, 1985, McDonald and Siegel, 1986, Pindyck, 1991, Dixit and Pindyck, 1994, Trigeorgis, 1996, Smith and McCardle, 1999). The underlying idea of the method is to assume a process for the stock price movements and use market data to represent time-risk preferences. The use of a traded security having similar risk and payoff characteristics to the project under analysis is the major advantage of this method over the traditional discounted cash flow approach. The key insight is that because the option values are independent of investors' risk preferences, the same valuations are obtained even when we assume that everyone is risk-neutral. This important assumption simplifies the calculations by eliminating the need to estimate the risk premium in the discount rate. See Amram and Kulatilaka (1998), Trigeorgis (1997), Kasanen and Trigeorgis (1994), and Mason and Merton (1985) for more on the use of risk-neutral pricing.

One advantage of the binomial lattice method is the representation of the growth option inherent to the project. In the case of Viracept, the growth option is represented by a second binomial lattice for a research phase NME whose value at the time of launch of the first NME is added to the last branch of the first NME's binomial tree. This approach takes into account elements of Copeland's (1998) discussion of compound rainbow options, and Amram and Kulatilaka's (1998) description of periodic reevaluations of decisions using a binomial approach.

The key inputs to the binomial lattice are: (*i*) current value of asset, *A*; (*ii*) standard deviation of the asset, $\sigma$; (*iii*) risk free rate, *r*; (*iv*) amount and timing of the exercise prices; and (*v*) probability of proceeding to the next phase of development. The value of Viracept at 6/30/94 is used to illustrate the calculation. The current value of the asset, *A*, is found by discounting the value of the expected commercialization cash flows to time zero:

$$\mathrm{A} = \sum_{j=1}^{5} q_j \sum_{t=1}^{T} \frac{CCF_{jt}}{(1+r_c)^t} = 123{,}921.$$

An n-period binomial lattice of asset values is constructed period by period. In the first period there are two possible outcomes, *Au* and *Ad*. In the second period there are three possible outcomes, $Au^2$, *Adu*, and $Ad^2$. The process of considering all possible combinations of up and down movements of the asset value for each period is continued until the $n^{th}$ period, which has end branch values $E_k$, k =1,...,n +1. Figure 3 illustrates a binomial lattice that represents four periods.

Following Amram and Kulatilaka (1998), we set $u = e^{\sigma}$ and $d = e^{-\sigma}$. Because we want the value of the NME to be able to grow from A to a maximum value of h after l years, we require $h = Au^l = Ae^{\sigma l}$. The value h represents the present value of a breakthrough drug at the time of launch. For l =12 and h =2,875,675, we get $\sigma = (1/l)\ln(h/A) = 26\%$. Thus, u =1.300 and d =0.769 for a 12-year binomial lattice with one price change per year.

The next step is to add in the value of the growth option. Engaging in the development of an initial NME is analogous to purchasing a call option on the value of a subsequent NME. By engaging in development of the initial NME, the firm earns the right but not the obligation to develop the subsequent NME. The assumptions for the growth option are identical to the first

option. The value of the growth option at the time of the launch of the first NME is added to each of the $E_k$ values of the first NME.

Once the binomial tree of asset values is completed, the next step is to calculate the possible payoffs and roll back the values using risk neutral probabilities. The possible payoffs are calculated as $P_k = \max[E_k(\theta_t) - DCF_t, 0]$, where the value $\theta_t$ is the probability of continuation to the next year in year t (in this case, 75%), and $DCF_t$ is the R&D payment that occurs in year t ($1,619). Because the value at launch of an NME is large (even if it is a dog) relative to the last year's R&D payment (exercise price) the possible payoff is very rarely (if ever) going to be zero.

The $P_k$ values are then rolled back by multiplying the adjacent values, such as $P_1$ and $P_2$ (denoted $V_{t+1,k}$ and $V_{t+1,k+1}$) by the respective risk neutral probabilities p and (1−p), the probability of continuation to the next year, and a discount factor to obtain $V_{t,k}$. The risk neutral probabilities are computed as:

$$p = \frac{e^{r\Delta t} - d}{u - d}$$

where the risk free rate, r, is the 10-year United States Treasury-bill rate, which was 7.09% in 1994. This results in p =0.573. Table 5 shows all the possible payoff values.

As the option values are rolled back, they are also adjusted for the probability of success at that phase of development and for the cost of development in that year. Thus the roll-back option values are:

$$V_{t,k} = \max[(pV_{t+1,k} + (1-p)V_{t+1,k+1})e^{-r\sqrt{\Delta t}}\theta_t - DCF_t, 0].$$

For a development stage having a duration of more than one year, $\theta_t$ is the probability of success for that stage in the final year of that stage and 1 for all other years. The amount $DCF_t$ can be regarded as an annual exercise price. For example, $V_{12,1}$ is calculated as follows:

$$(2{,}156{,}669(.573) + 1{,}276{,}979(1 - .573)).9316(1) - 1{,}564 = 1{,}657{,}654.$$

This process is then continued until $V_{1,1}$ is reached, which is the value of the firm.

**Influence Diagram Representation**

An influence diagram is a powerful decision analysis tool for representing and solving decision problems. It combines a graphical model that represents the underlying structure of the problem with a numerical database that represents the uncertainty and value associated with the variables in the model. An ID representation of a decision problem was initially proposed as a more compact prelude to constructing a DT representation (Miller et. al, 1976, Howard and Matheson, 1981). One major advantage of IDs is that the graphical representation grows linearly with the number of variables in the problem whereas decision trees and binomial trees grow exponentially. So, decision problems that include sequential phases (as in real options) can be represented in a more compact way thus making it easier for the decision-maker to see different aspects of the problem. From the practitioner's perspective, an ID representation is both intuitive and compact, so it is a powerful tool for communication, elicitation, and detailed representation of a decision maker's knowledge (Shenoy, 1994).

In addition to the representational compactness, IDs also have advantages for the solution of the problem. The key is to decompose uncertainty and utility into separate functional forms and then solve the problem locally (Olmsted, 1983 and Shachter, 1986). This approach leads to a

great deal of efficiency at the solution phase, especially for large scale problems. Furthermore, the automation of ID representation with easy-to-use software has made IDs very popular for representing and solving decision problems.

Assuming that utility and uncertainty are specified correctly, an influence diagram is equivalent to a decision tree model, i.e., both solution techniques yield the same optimal strategy. Further, Smith and Nau (1995) argue that, under certain conditions, a decision tree model gives the same results as an option-based model. These arguments support the idea that IDs can be a useful tool to represent and solve real options problems. As we show later, representation of different underlying sources of uncertainty through IDs improves the predictive capability of the model and leads to better estimates of Agouron's share value than the decision tree and binomial lattice valuations.

In the case of Agouron, the firm's decision problem includes seven phases. At each phase, the firm first observes the results of tests for that phase. The firm then makes a decision whether to continue or abandon the project. So, having observed test results, the firm has the option to abandon the project at the end of each phase. If the firm decides to abandon the project at a given phase, then the outcome for that phase is called a failure. Therefore, the outcome of a given phase is represented by two states —*success* or *failure*. However, this problem has an asymmetric structure because not all the possible outcomes are allowed at each phase of the project. For example, if the project is abandoned at phase $t - 1$, i.e. the outcome for that phase is failure, this implies that the project at phase t has already been abandoned. Thus, we will collapse all the future outcomes of the remaining phases into one outcome called *no result*. Such an asymmetric structure is common to many real options problems. However, although the asymmetric structure can be used to simplify the DT representation, inclusion of additional uncertainties (discount rates, inflation, volatility, etc.) in the model may still make the DT representation impractical for large-scale problems.

The influence diagram for Agouron is given in Figure 4. In an influence diagram, decisions, chance, and value variables are represented as separate nodes.

**Decision nodes**: The decisions available to the decision-maker are represented using rectangular nodes in the ID. The investment project consists of seven phases Discovery, Pre-clinical, Phase 1, Phase 2, Phase 3, FDA Filing, and Post-approval. At each phase, the firm has two alternatives: continue or abandon the project. However, the structure of Agouron's decision problem does not require the use of decision nodes because the decision is implied by the outcome of each phase. More specifically, at each decision point, having observed the results of each development stage of the project, the decision maker has the option of continuing or abandoning the project. By definition, once it is decided that the project should be abandoned, then the outcome is called a failure; otherwise it is called a success. Therefore, the ID model represents these implied decisions for the abandonment options using chance nodes only. We represent this asymmetric structure of decisions through the probability distribution of chance variables as explained next.

**Chance nodes**: Uncertainty is represented through the use of chance variables depicted as single-border oval nodes in the diagram. The ID for Agouron includes ten chance variables. The nodes *Real NCDR*, *I*, and *Real CDR* represent the real non-commercial, inflation, and the real commercial discount rates respectively. Each of these rates is a random variable used in the present value calculations of project cash flows for different stages. The probability distribution for inflation is obtained by using annual inflation values for the years 1983 to 1997. We

approximated the continuous distribution for this variable using the bracket-median method of Clemen (1991). There are several other methods available to discretize continuous distributions; however, we chose one of the simplest methods because the selection of a discretization method is not a major focus in this paper. The reader is referred to Smith (1993) for a comparison of different discretization methods.

For *Real NCDR* and *Real CDR*, we used 6% and 9% respectively to be comparable with the DT model used in Kellogg and Charnes (2000). However, assigning a probability distribution to real rates of return is easy with an ID and allows us to extend the DT model. The remaining seven chance variables are *D, PC, P1, P2, P3, FDA*, and *PostAp*. These variables represent the uncertain outcome of the seven phases of the project as success (*s*), failure (*f*) or no result (*nr*) if the previous phase has failed. For example, the node PC in the diagram represents the uncertain outcome of the Pre-clinical phase and has state space (*s,f,nr*). The variables represented by the ID nodes are summarized in Table 6.

One major advantage of the influence diagram is the compact representation of uncertainty in the model. An arrow between two chance nodes indicates a conditional probability distribution linking the two chance variables. For example, the arrow from node D to node *P*C indicates that the outcome of the Pre-clinical phase is conditioned on the outcome of the Discovery phase. Similarly, the arrow from *P*1 to *P*2 indicates the conditional distribution of Phase 2 results given the outcome of Phase 1. One special structure we implement in the model is to assign 100% probability to outcome *n*o *resul*t (nr) in project stage t if the outcome of stage t − 1 is either *failur*e or *n*o *result*. So for example, the conditional probability distribution for Phase 2 given Phase 1 is

$$P(P2 \mid P1) = \begin{cases} 0.75\,(\text{s}), 0.25\,(\text{f}), 0\,(\text{nr}) & \text{if P1} = \text{s} \\ 0\,(\text{s}), 0\,(\text{f}), 1\,(\text{nr}) & \text{if P1} = \text{f} \\ 0\,(\text{s}), 0\,(\text{f}), 1\,(\text{nr}) & \text{if P1} = \text{nr} \end{cases}$$

Using conditional probability distributions in the influence diagram allows us to factorize the global uncertainty into local factors. In the context of Agouron, this means that the outcome of stage *t*is independent of the outcome of stage *t*− 2 given the outcome of stage *t*− 1. For example, knowledge of the outcome of Phase 3 is all we need for inference on the outcome of FDA filing phase. Mathematically this means $P(FDA|D,PC,P1,P2,P3) = P(FDA|P3)$. The structuring of nodes *D, PC, P1, P2, P3, FDA*, and *PostAp* in the ID represents a factorization of uncertainty into the following form:

$$P(D,PC,P1,P2,P3,FDA) = P(D) \cdot P(PC|D) \cdot P(P1|PC) \cdot P(P2|P1) \cdot P(P3|P2) \cdot P(FDA|P3) \cdot P(PostAp|FDA)$$

The uncertainty representation for project outcomes at each phase represents the decision maker's option to abandon the project after observing the results of a given phase. Once it is decided that the project should be abandoned at a particular phase of the project, then the outcome is deemed a failure.

**Deterministic nodes**: In addition to chance variables, we use double ovals to represent the deterministic variables that have only one possible outcome given the state of its predecessors. A deterministic variable is a special case of a chance variable that takes on a single deterministic value as a function of its predecessors. For each deterministic variable, we specify a mathematical function that yields its value. We used two groups of deterministic nodes: The first

group consists of variables *NCDR* and *CDR*, i.e. the nominal non-commercial and commercial discount rates. The variables are deterministic functions of their probabilistic predecessors as

$$NCDR = (1+I) \cdot (1 + RealNCDR) - 1$$
$$CDR = (1+I) \cdot (1 + RealCDR) - 1$$

The second group of deterministic variables consists of cash flow variables for each of the seven phases of the project: *CF*(*D*), *CF*(*PC*), *CF*(*P*1), *CF*(*P*2), *CF*(*P*3), *CF*(*FDA*), *CF*(*PostApp*).We choose to define cash flow variables locally for each phase as this simplifies the ID both in terms of representation and also solution. The value of each cash flow variable is determined by the outcome of the particular phase, the projected cost/revenue figures, and the values of discount rate and inflation. We used the non-commercial discount rate for the phases, discovery through FDA filing and the commercial discount rate for the commercial phase, *PostAp*. In order to make the point clear, consider the first phase which is the discovery. Its duration is estimated to be one year and the cost of this phase is estimated as \$2,200 (all cost and revenue figures in \$000*s*). If the decision maker decides to abandon the project at this particular phase, then the outcome is called a failure and we are left with the costs already incurred in this phase. However, if we decide to continue the project, the outcome is called a success and the cash flow contribution is zero for that particular phase. Therefore, the cash flow node for the discovery phase, *CF*(*D*), contains the formula

$$CF(D) = \begin{cases} 0 & \text{if D = s} \\ \frac{-2{,}200}{(1+\text{NCDR})} & \text{if D = f} \end{cases}$$

So, given the state of noncommercial discount rate and the outcome of the *Discover*y phase, *CF*(*D*) has no uncertainty. However, as we continue the project, we account for the effects of inflation, so the remaining cash flow nodes contain the inflation variable as an additional input. Let us now consider the next phase, the pre-clinical phase. Pre-clinical studies take three years and the estimated total cost for this phase is \$13, 800. We assumed that this cost will be equally distributed through years during this phase, so we divide this total cost estimate into three. However, since these costs are defined in today's terms, we increase the costs at the rate of inflation. Finally, we calculate the net present value for the cash flows at this phase by discounting at the non-commercial discount rate. If we decide to abandon the project after the Preclinical phase, the total cash flow incurred is what has been spent until the previous phase, *C*F (*D*), plus what is spent in the current phase, i.e.

$$CF(PC) = \begin{cases} 0 & \text{if D = s} \\ \frac{-2{,}200}{(1+\text{NCDR})} - \frac{-13{,}800}{3}\left[\frac{(1+I)}{(1+\text{NCDR})^2} + \cdots + \frac{(1+I)^3}{(1+\text{NCDR})^4}\right] & \text{if P1 = f} \\ 0 & \text{if PC = nr} \end{cases}$$

The cash flow variables for all the non-commercial phases *Discover*y through *FDA Filing*, are formulated similarly. The final phase is the Post-Approval phase, where the revenue estimates come into play. The cash flow variable for this phase, *C*F (*PostAp*), is formulated in a

similar manner, however this time the commercial discount rate is used in the calculations. We used the annual revenue estimates for the next 23 years after the launch of the product (see Figure 1), which are taken from Kellogg and Charnes (2000). We have five series of revenue estimates each for a particular outcome of the final stage, '*dog*' through '*breakthrough*'. Revenue estimates are defined in future value terms, so inflation does not appear in the formulas; however, we discount these numbers at the commercial discount rate. So, the cash flow for this phase includes what has been incurred as accumulated costs so far plus the net present value of the revenues for the next 23 years. Clearly, these revenue streams will be a function of the outcome of this phase. Although the expression is long, the following should make the point clearer.

$$CF(PostAp) = \begin{cases} -\text{Cost(FDA)} + \frac{-42{,}843}{(1+\text{CDR})^{14}} + \cdots + \frac{270{,}727}{(1+\text{CDR})^{36}} & \text{if PostAp} = bt \\ -\text{Cost(FDA)} + \frac{-42{,}843}{(1+\text{CDR})^{14}} + \cdots + \frac{135{,}363}{(1+\text{CDR})^{36}} & \text{if PostAp} = aa \\ -\text{Cost(FDA)} + \frac{-6{,}407}{(1+\text{CDR})^{14}} + \cdots + \frac{13{,}537}{(1+\text{CDR})^{36}} & \text{if PostAp} = a \\ -\text{Cost(FDA)} + \frac{-84{,}674}{(1+\text{CDR})^{14}} + \cdots + \frac{1{,}521}{(1+\text{CDR})^{36}} & \text{if PostAp} = ba \\ -\text{Cost(FDA)} + \frac{-93{,}141}{(1+\text{CDR})^{14}} + \cdots + \frac{1{,}353}{(1+\text{CDR})^{36}} & \text{if PostAp} = d \\ -0 & \text{if PostAp} = nr \end{cases}$$

where *Cost*(*FDA*)is the sum of the costs of all prior stages including FDA filing, i.e. *Discover*y through *FDAfiling*.

**Value node**: The net present value of the entire project is calculated in this node. This value is simply the sum of contributions of each stage of the project, i.e.

$$\text{NPV(Project)} = \sum_{s=D}^{PostAp} CF(s)$$

## RESULTS

In this section we present our estimates of Agouron's share values for five selected dates and compare the results with actual stock prices as well as the estimates from Kellogg and Charnes (2000). The influence diagram gives us an estimate for the net present value of the Viracept project. We compute the value of Agouron Pharmaceuticals, Inc., as the sum of the values of its current projects, the largest of which by far was Viracept. Finally, we calculate the per share value of Agouron after dividing this sum by the number of fully diluted shares, i.e. shares outstanding plus warrants issued. Table 7 shows the values of Agouron Pharmaceuticals, Inc. obtained using the influence diagram, decision tree and binomial lattice methods. The actual stock prices are also shown for comparison.

The significance of the selected dates is

1. June 1994—fiscal year end. Viracept was undergoing preclinical trials;
2. October 20, 1994—announcement that Viracept would begin Phase I trials;
3. June 1995—fiscal year end;
4. June 1996—fiscal year end; and
5. December 23, 1996—announcement that Agouron was filing a New Drug Application (NDA) for Viracept.

One advantage of the ID framework is that valuation of the project for selected dates is done simply by entering evidence on selected sources of uncertainty in the problem. For example, consider the October 20, 1994 valuation. We know that the Discovery phase had passed successfully so this is entered as evidence to the node representing the outcome for this phase, i.e. node D. Our results indicate that the influence diagram can be a powerful alternative to the decision tree and binomial lattice models. We get better estimates on 4 out of 5 selected dates. With the exception of October 1994, the influence diagram improves estimates by at least 10% in the worst case (December 1996) and by 32% in the best case (June 1995). This is not a surprising result as further inclusion of fundamental sources of uncertainty should lead to better estimates. One should note that this can be done within the decision tree or binomial lattice framework; however, this would very much enlarge the representation and complicate the solution of these models. Our main point is that influence diagrams are extremely useful because they represent compactly the uncertainty underlying real options and thus enable us to represent and solve a larger class of models than we can with the DT and binomial lattice techniques. Furthermore, scenario-dependent discount rates, i.e. discount rates applicable to path-dependent cash flows resulting from managerial flexibility, can be modeled effectively using an ID, which in turn makes it possible to use an NPV-based methodology to value real options.

Table 7 indicates that all methods valued Agouron relatively well when the project was in Phase I or earlier, but the calculated values deviated further from the actual stock price as Viracept worked its way through the development process. Thus it appears that investors were making different assumptions regarding the later development stages of this NME than they would have made for the typical NME specified in the model. If so, and if our model is adjusted for these assumptions, we expect that the valuation given by the model would be much closer to the actual stock price.

There are several reasons to believe that investors were making different assumptions. First, there was tremendous political pressure for the FDA to approve drugs for HIV-positive patients. Therefore, investors might have assumed that it would take less than eight years from beginning of Phase II until launch. In fact, it took slightly less than two years. Another important assumption is the probability distribution of the revenue stream. An assumption of our model is an 80% probability that revenue will be under $100 million per year at peak. In fact, sales of Viracept were over $400 million during fiscal year 1998 (its first full year of sales) and were $548M in 1999 per NDCHealth. Again, it is likely that the market was assuming a different probability distribution for revenue. Finally, it is likely that the market assumed a probability of approval for Viracept greater than that for a typical NME.

## CONCLUSION

This paper suggests using influence diagrams as an effective tool to value real options. We use an influence diagram to compute the value of a biotechnology firm, Agouron Pharmaceuticals, Inc., as the sum of the values of its current projects. We estimate share prices for Agouron at selected points in time during the development of Viracept, a drug used to treat HIV-positive patients. We then compare our computed values to actual market values as well as to the decision tree and binomial lattice estimates of Kellogg and Charnes (2000). The influence diagram yields better estimates of Agouron's stock price on 4 out of the 5 selected dates. With the exception of October 1994, the influence diagram improves the estimates by at least 10% in the worst case and by 32% in the best case.

A major advantage of the influence diagram framework is that it allows for compact representation of different fundamental sources of uncertainty as well as scenario-dependent cash flows resulting from managerial flexibility. In the case of Agouron, a simple modification to discount rates improves the predictive capability of the model and leads to better estimates of the company's share value as compared to the decision tree and binomial lattice valuations. Considering the representation side of the problem, an influence diagram is more descriptive than a binomial lattice and it can represent real options problems that involve multiple uncertainties and sequential decisions much more compactly than a decision tree. Further, the process of building the ID requires communication among analysts and decision makers that leads to a better model. Considering the solution aspect, influence diagrams make use of conditional independence arguments that allow factorization of global uncertainty into smaller, local domains. Finally, our results add support to the suggestion that managerial flexibility in projects can be valued using the net present value framework, if applied correctly. The fact that scenario-dependent discount rates, i.e. discount rates applicable to path-dependent cash flows resulting from managerial flexibility, can be modeled in an effective manner using an ID, makes it possible to use an NPV-based methodology to value real options. Influence diagrams should be considered by corporate managers as a powerful alternative for the representation and solution of real options.

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**Figure 1: Revenue streams ($US millions, on logarithmic scale) for new drugs by quality category. Sources: Years 1–13 from Myers and Howe (1997), Years 14–24 from OTA.**

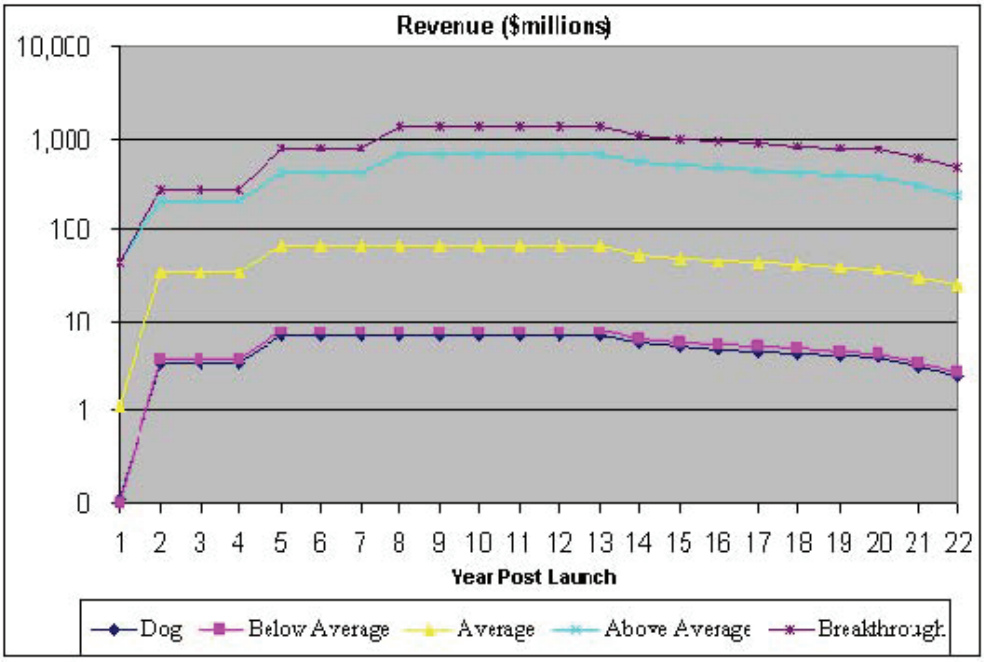

**Figure 2: Decision Tree for Pharmaceutical Development**

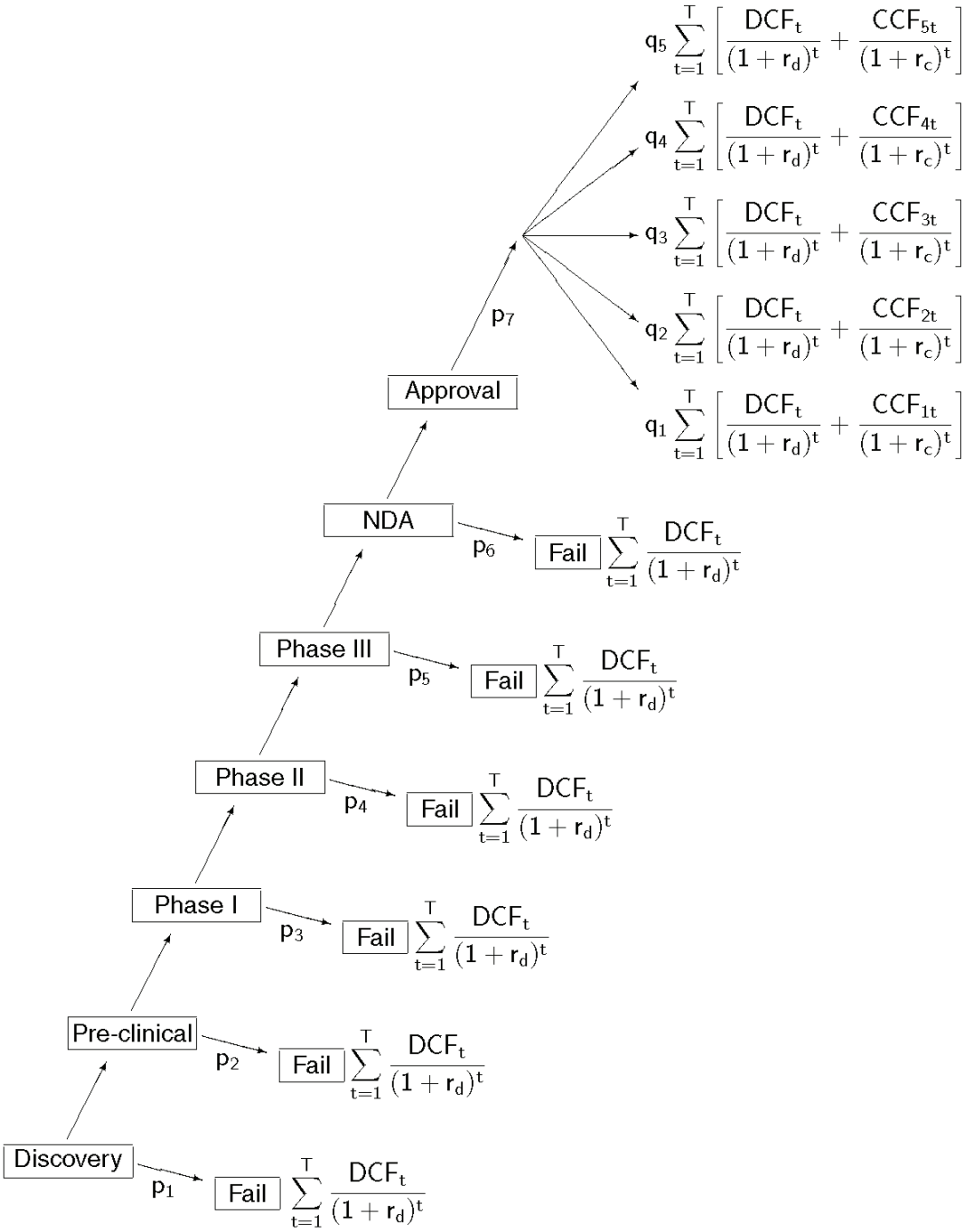

**Figure 3: Four-Period Binomial Lattice**

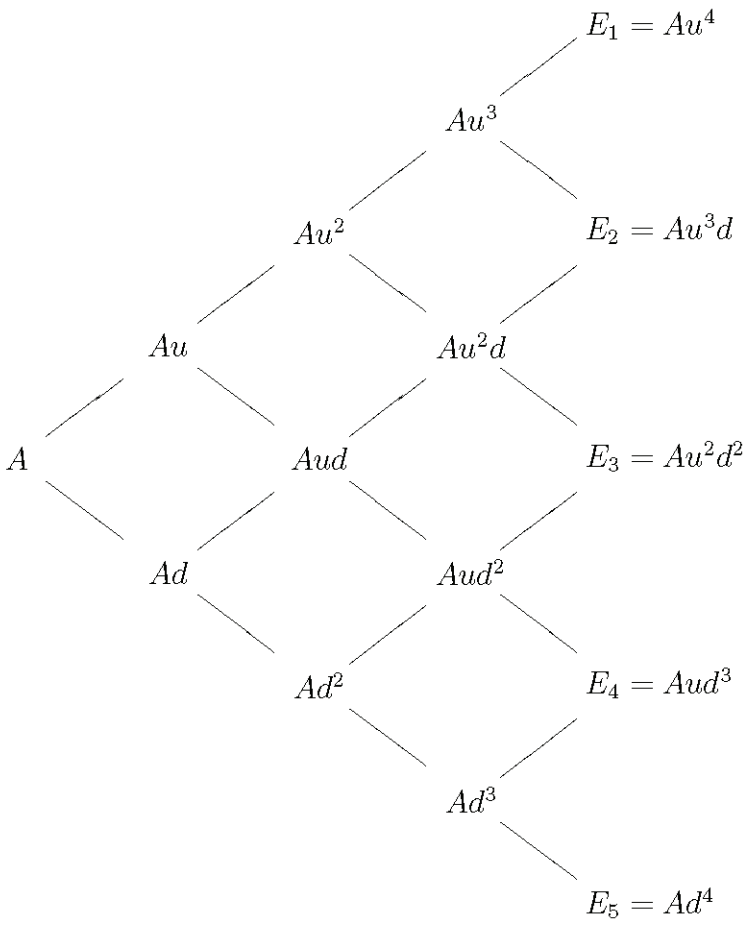

**Figure 4: The ID representation of Agouron's decision problem for Viracept.**

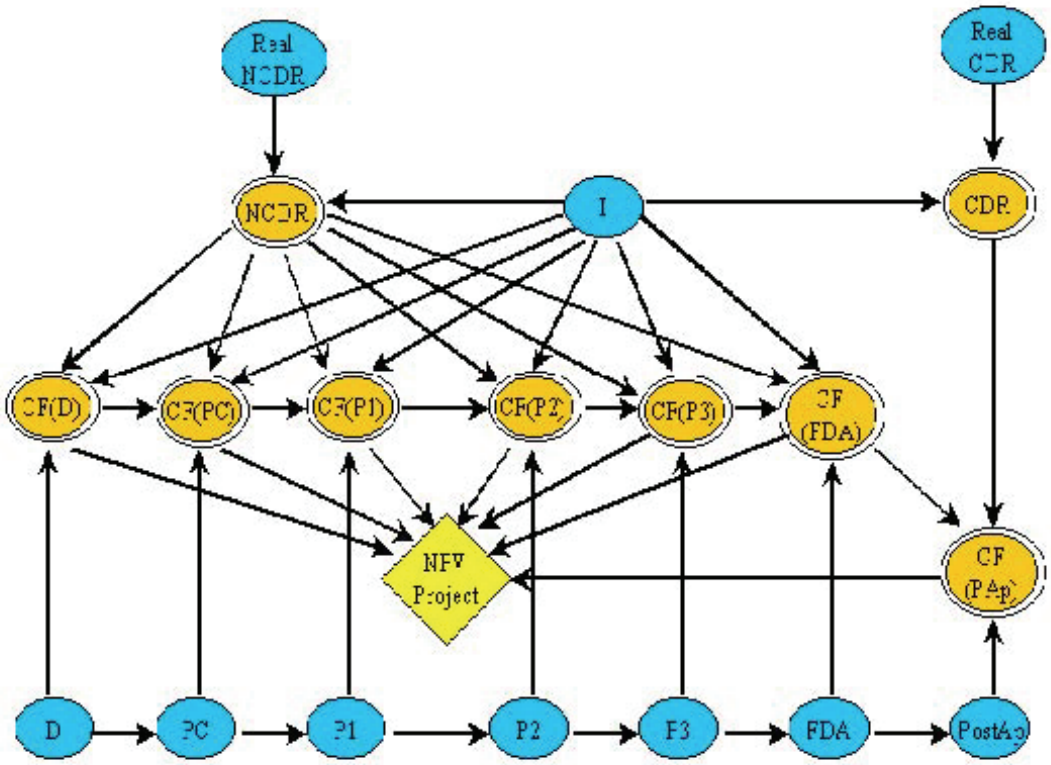

**Table 1: Peak annual revenue ($US 000's) by quality category. (Source: Myers and Howe, 1997)**

| **Quality** | **Peak Revenue** |
|---|---|
| Breakthrough | 1,323,920 |
| Above Average | 661,960 |
| Average | 66,200 |
| Below Average | 7,440 |
| Dog | 6,620 |

**Table 2: Pre-tax costs of development, durations and conditional probabilities of success for drug research and development stages. (Source: Myers and Howe, 1997)**

| R&D Stage | Total Cost ($000s) | Years in Stage | Conditional Pr(success) |
|---|---|---|---|
| Discovery | 2,200 | 1 | .60 |
| Pre Clinical | 13,800 | 3 | .90 |
| Phase I | 2,800 | 1 | .75 |
| Phase II | 6,400 | 2 | .50 |
| Phase III | 18,100 | 3 | .85 |
| FDA Filing | 3,300 | 3 | .75 |
| Post-Approval | 31,200 | 9 | 1.00 |

**Table 3: Other assumptions.**

| Item | Assumption | Source |
|---|---|---|
| Cost of Revenue | 25.5% of revenue | OTA |
| Marketing Expense | 100% of revenue in the first year after launch<br>50% of revenue in year 2 after launch<br>25% of revenue in years 3–4 after launch<br>20% of revenue in years 5–13 after launch | Myers |
| G&A Expense | 11.1% of revenue | OTA |
| Tax Rate | 35% of profit | Myers |
| Working Capital | 17% of Revenue | OTA |

**Table 4: ENPV Calculation of a discovery phase NME in 1994 ($US 000s)**

| **End Phase** | ***i*** | ***j*** | **(1)** $p_i$ | **(2)** $q_j$ | **(3)** $\sum_{t=1}^{T} \frac{DCF_t}{(1+r_d)^t}$ | **(4)** $\sum_{t=1}^{T} \frac{CCF_{jt}}{(1+r_c)^t}$ | **((4)-(3)) × (1)×(2)** |
|---|---|---|---|---|---|---|---|
| Discovery | 1 | | .400 | | 2,004 | | −802 |
| Pre-clinical | 2 | | .060 | | 13,203 | | −792 |
| Phase I | 3 | | .135 | | 15,223 | | −2,055 |
| Phase II | 4 | | .203 | | 19,455 | | −3,949 |
| Phase III | 5 | | .030 | | 29,810 | | −894 |
| NDA submission | 6 | | .043 | | 31,395 | | −1,350 |
| Approval | 7 | | .129 | | | | |
| Dog | | 1 | | .10 | 31,395 | 3,762 | −356 |
| Below average | | 2 | | .10 | 31,395 | 4,230 | −350 |
| Average | | 3 | | .60 | 31,395 | 33,011 | 125 |
| Above average | | 4 | | .10 | 31,395 | 315,819 | 3,669 |
| Breakthrough | | 5 | | .10 | 31,395 | 615,013 | 7,529 |

**ENPV = 775**

**Table 5: Calculation of the possible Payoff values ($US 000s) for $DCF_t$ =1, 619, $\theta_t$ =0.75, and value of growth option = $2,085.**

| $k$ | $E_k$ | $P_k$ |
|---|---|---|
| 1 | 2,877,759 | 2,156,699 |
| 2 | 1,704,795 | 1,276,976 |
| 3 | 1,010,273 | 756,085 |
| 4 | 599,041 | 447,661 |
| 5 | 355,548 | 265,041 |
| 6 | 211,373 | 156,910 |
| 7 | 126,006 | 92,885 |
| 8 | 75,460 | 54,975 |
| 9 | 45,531 | 32,528 |
| 10 | 27,810 | 19,238 |
| 11 | 17,317 | 11,368 |
| 12 | 11,104 | 6,708 |
| 13 | 7,425 | 3,949 |

**Table 6: Descriptions of Influence Diagram nodes. Node Description Node Type State Space**

| Node | Description | Node Type | State Space |
|---|---|---|---|
| D | Discovery results | Chance (C) | {success(s), failure(f)} |
| PC | Pre-clinical test results | C | {s , f, no result (nr) } |
| P1 | Phase 1 results | C | {s , f, nr } |
| P2 | Phase 2 results | C | {s , f, nr } |
| P3 | Phase 3 results | C | {s , f, nr } |
| FDA | FDA filing results | C | {s , f, nr } |
| PostApp | Post-approval results | C | {dog (d), below average (ba), average (a), above average (aa), breakthrough (bt)} |
| Real NCDR | Real Noncommercial discount rate | Deterministic (D) | {6%} |
| Real CDR | Real Commercial discount rate | Deterministic (D) | {9%} |
| I | Inflation | C | {3.18%, 4.00%, 4.20%} |
| NCDR | Noncommercial discount rate | D | |
| CDR | Commercial discount rate | D | |
| CF(D) | Discovery phase cashflow | D | |
| CF(PC) | Pre-clinical phase cashflow | D | |
| CF (*P*1) | Phase 1 cashflow | D | |
| CF (*P*2) | Phase 2 cashflow | D | |
| CF (*P*3) | Phase 3 cashflow | D | |
| CF(FDA) | FDA filing phase cashflow | D | |
| CF(PostApp) | PostApproval phase cashflow | D | |
| NPV(Project) | Net present value of the project | Value (V) | |

**Table 7: Actual per-share values of Agouron stock and the valuations obtained through the Influence-Diagram, Binomial-Lattice and Decision-Tree methods. Values in parentheses are the differences in percent between the actual stock price and the price given by each valuation method. (The estimates for Binomial-Lattice and Decision-Tree methods are taken from Kellogg and Charnes, 2000)**

| Date | Stock Price | Method: Influence Diagram | | Binomial | | Decision Tree | |
|---|---|---|---|---|---|---|---|
| 6/30/94 | $ 5.63 | $ 5.17 | (−8.1) | $ 4.51 | (−19.8) | $ 4.31 | (−23.4) |
| 10/20/94 | 5.63 | 6.56 | (+16.6) | 5.87 | (+4.3) | $ 5.70 | (+1.4) |
| 6/30/95 | 11.81 | 10.93 | (−7.5) | 8.51 | (−27.9) | $ 7.17 | (−39.3) |
| 6/30/96 | 19.50 | 13.61 | (−30.2) | 10.44 | (−46.5) | $ 10.26 | (-47.4) |
| 12/23/96 | 33.88 | 18.40 | (−45.7) | 15.45 | (−54.4) | $ 15.05 | (-55.6) |

# SHORTER CASES AND EXERCISES

***In 2008, the Institute plans to begin publishing a new outlet (currently unnamed) for shorter, simpler cases and classroom exercises. The three contributions in this section are representative of the type of exercise that many of us use on a regular basis, but seldom get a chance to share with our peers. If you have short cases, exercises or tutorials that you have used in class and would like to share with others, please submit them to the editor for consideration. This new publication will be editorially reviewed and distributed with the Journal or as it becomes available throughout each year.***

# CAPITAL CITY CORPORATION: A CASE STUDY IN FINANCIAL ANALYSIS AND FORECASTING FOR SHAREHOLDER VALUE CREATION

**Robert Irons, Dominican University**
**Robert A. Weigand, Washburn University**

*A firm's senior management team must reach a consensus regarding key strategic decisions available to the company. A comprehensive financial analysis of the firm's past performance and future prospects is necessary to determine if restoring the firm's financial ratios to recent levels creates the maximum possible value for shareholders, or if more value would be created by simultaneously investing in a major new project. Decision criteria for the case include traditional accounting metrics (return on assets, return on equity, earnings per share and dividends per share) as well as value creation metrics such as net operating profit after tax, return on invested capital, economic value added, and market value added. Most of the conceptual and analytical material covered in a one-semester Financial Management class is used to arrive at and justify a final decision. The case highlights the need to extend management's evaluation horizon when making long-term strategic decisions. Another innovative aspect of the case is the use of the MSN Money Central financial statement formats, which means the required spreadsheet models can be used by students and faculty to conduct the same financial analysis and financial statement forecasts for any publicly-traded company. The conceptual complexity and extensive spreadsheet modeling required to solve the case make it an appropriate term project for undergraduate seniors or MBAs. The case is designed so that smaller segments can be introduced over several class sessions. Expected time to complete the* ***entire*** *case analysis is 18-24 hours outside of class.*

Capital City Corporation is a U.S.-based manufacturing firm that produces home improvement products for the consumer market. Having incorporated in January of 1992, the firm has just completed its thirteenth full year in business. Based on three years of strong growth in sales and profits, the firm's board decided to go public in 1995. Capital City's IPO stock price was $8.00 per share, and over the next few years the price of their stock climbed as high as $20.00. Since 2001, however, the firm's share price has steadily declined. Market analysts have recently been critical of Capital City's management team, pointing out the firm's lack of growth and management's inability to create shareholder value. (Capital City's 2000-2004 financial statements are presented in Exhibits 1 and 2.)

The firm's executives are divided regarding the best course of action. The Sales and Marketing managers believe shareholders would be best served if Capital City focused on a straightforward restructuring that would restore the firm's operating and financial ratios to their

average values from 2001-2004. Their analysis indicates that restoring the firm's recent operating and financial ratios would result in growth in earnings and dividends per share, and improve key financial metrics. Moreover, the firm would generate greater free cash flow that could be used to increase dividends, repurchase shares, or continue paying down debt, which has been declining in recent years.

The Operations and Finance managers, on the other hand, argue that the restructuring alone will not provide sufficient growth to satisfy markets and analysts. Their position is that, in addition to the restructuring, the firm needs to upgrade manufacturing processes in key product lines to increase capacity and allow for growth in sales. Their analysis shows this investment (details provided in Exhibit 3) will further improve the firm's performance metrics in the intermediate term, as well as demonstrate to analysts that Capital City is committed to growth and increasing shareholder value.

The Sales and Marketing managers are opposed to this proposal because the investment will be entirely funded with a large amount of debt due to the cost of bringing the new technology on board. This group's analysis also shows that many of the firm's key performance metrics worsen if the firm invests in the project. The Operations and Finance managers counter that the Sales and Marketing managers are focusing exclusively on the short term, and remain convinced that the firm's performance metrics and stock price will substantially improve after several years if the new project is adopted. They argue that this is the same focus on the short term which has contributed to the firm's poor performance in recent years. They also assert that if management cannot prove to the market that Capital City is capable of growth, their firm may become the target of an unwanted takeover offer.

Both groups of managers agree that before they can determine which approach is in the best interest of Capital City's shareholders, a thorough financial analysis of the firm's recent performance and forecasted performance under the different scenarios is required. Capital City's board of directors has requested that managers hire an outside consulting firm to assess the firm's current position and make recommendations for a value creation strategy likely to have the most positive influence on the company's stock price and performance metrics.

## Exhibit 1. Capital City Corporation Balance Sheets 2000 – 2004

| Fiscal Year Ending Dec 31 (thousands) | 2004 | 2003 | 2002 | 2001 | 2000 |
|---|---|---|---|---|---|
| **Assets** | | | | | |
| **Current assets** | | | | | |
| Cash and equivalents | 3,438.4 | 3,110.8 | 1,664.6 | 2,188.1 | 1,919.4 |
| Receivables | 4,070.6 | 3,878.3 | 3,105.5 | 2,558.0 | 2,243.9 |
| Inventories | 2,231.1 | 2,075.8 | 1,899.9 | 1,653.0 | 1,450.0 |
| Other Current Assets | 4,494.3 | 4,313.6 | 4,411.7 | 3,918.8 | 3,437.5 |
| **Total current assets** | **14,234.4** | **13,378.5** | **11,081.7** | **10,317.9** | **9,050.8** |
| **Non-Current assets** | | | | | |
| Property and equipment, gross | 19,949.6 | 16,402.2 | 12,840.1 | 10,133.7 | 7,989.5 |
| Accum. Depreciation and Depletion | 8,804.7 | 7,247.8 | 4,986.0 | 4,194.6 | 3,670.9 |
| **Property and equipment, net** | **11,144.9** | **9,154.4** | **7,854.1** | **5,939.1** | **4,318.6** |
| Intangibles | 7,056.7 | 6,675.8 | 5,318.2 | 5,014.9 | 4,399.1 |
| Other Non-Current Assets | 4,796.5 | 3,753.9 | 2,923.0 | 2,279.3 | 1,759.5 |
| **Total Non-Current Assets** | **22,998.1** | **19,584.1** | **16,095.3** | **13,233.3** | **10,477.2** |
| **Total assets** | **$37,232.5** | **$32,962.6** | **$27,177.0** | **$23,551.2** | **$19,528.0** |
| | | | | | |
| **Liabilities and stockholders' equity** | | | | | |
| **Current liabilities** | | | | | |
| Accounts payable | 3,114.8 | 2,873.0 | 2,082.8 | 1,568.0 | 1,375.4 |
| Short-term Debt | 1,314.7 | 1,626.4 | 745.3 | 1,859.2 | 2,250.0 |
| Other Current Liabilities | 5,017.5 | 4,248.2 | 3,284.9 | 2,394.1 | 2,249.2 |
| **Total current liabilities** | **9,447.0** | **8,747.6** | **6,113.0** | **5,821.3** | **5,874.6** |
| **Non-current liabilities** | | | | | |
| Long-term debt | 5,308.2 | 5,701.3 | 5,701.3 | 5,701.3 | 5,701.3 |
| Deferred income taxes | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other non-current liabilities | 0.0 | 478.4 | 1,092.5 | 1,842.7 | 1,696.7 |
| Minority interest | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total non-current liabilities** | **5,308.2** | **6,179.7** | **6,793.8** | **7,544.0** | **7,398.0** |
| **Total liabilities** | **14,755.2** | **14,927.3** | **12,906.8** | **13,365.3** | **13,272.6** |
| | | | | | |
| **Stockholders' equity:** | | | | | |
| Preferred Stock | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Retained Earnings | 11,829.4 | 9,277.5 | 7,312.4 | 4,848.1 | 2,402.5 |
| Common Stock | 10,647.9 | 8,757.8 | 6,957.8 | 5,337.8 | 3,852.9 |
| **Total stockholders' equity** | **22,477.3** | **18,035.3** | **14,270.2** | **10,185.9** | **6,255.4** |
| **Total liab. and stockholders' equity** | **$37,232.5** | **$32,962.6** | **$27,177.0** | **$23,551.2** | **$19,528.0** |
| | | | | | |
| Shares Outstanding (thousands) | 4,500 | 4,500 | 4,500 | 4,500 | 4,500 |

## Exhibit 2. Capital City Corporation Income Statements 2000 – 2004

| Fiscal Year Ending Dec 31 (thousands) | 2004 | 2003 | 2002 | 2001 | 2000 |
|---|---|---|---|---|---|
| Sales Revenue | 28,214.9 | 24,218.8 | 20,878.3 | 18,234.3 | 15,995.0 |
| Cost of sales | 13,845.8 | 11,349.1 | 9,302.5 | 7,625.0 | 6,250.0 |
| **Gross Operating Profit** | **14,369.1** | **12,869.7** | **11,575.8** | **10,609.3** | **9,745.0** |
| Selling, General and Administrative Exp. | 5,524.0 | 4,834.1 | 3,535.6 | 2,898.0 | 2,415.0 |
| Other taxes | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **EBITDA** | **8,845.1** | **8,035.6** | **8,040.2** | **7,711.3** | **7,330.0** |
| Depreciation and Amortization | 1,556.9 | 1,365.7 | 1,187.6 | 1,023.8 | 875.0 |
| **EBIT** | **7,288.2** | **6,669.9** | **6,852.6** | **6,687.5** | **6,455.0** |
| Other income (net) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Income available for interest expense | 7,288.2 | 6,669.9 | 6,852.6 | 6,687.5 | 6,455.0 |
| **Interest expense** | **576.3** | **635.1** | **569.0** | **652.6** | **681.9** |
| Minority interest | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Pre-tax income** | **6,711.9** | **6,034.8** | **6,283.6** | **6,034.9** | **5,773.1** |
| Income taxes | 2,269.9 | 2,269.7 | 2,199.3 | 2,104.4 | 2,020.6 |
| Special Income/Charges | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Income from Continuing Operations** | **4,442.0** | **3,765.1** | **4,084.3** | **3,930.5** | **3,752.5** |
| Net Income from Discontinued Operations | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Normalized Income** | **4,442.0** | **3,765.1** | **4,084.3** | **3,930.5** | **3,752.5** |
| Extraordinary Income | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Income from Cum. Effect of Acct Changes | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Income from Tax Loss Carryforward | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Gains (Losses) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total Net Income** | **4,442.0** | **3,765.1** | **4,084.3** | **3,930.5** | **3,752.5** |
| **Dividends per share** | **0.42** | **0.40** | **0.36** | **0.33** | **0.30** |
| Preferred Dividends | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Addition to Retained Earnings** | **2,552.0** | **1,965.1** | **2,464.3** | **2,445.5** | **2,402.5** |
| **EPS from Total Operations** | **0.99** | **0.84** | **0.91** | **0.87** | **0.83** |
| Diluted EPS from Total Operations | 0.99 | 0.84 | 0.91 | 0.87 | 0.83 |
| Income Tax Rate | 33.8% | 37.6% | 35.0% | 34.9% | 35.0% |
| Shares Outstanding (thousands) | 4,500 | 4,500 | 4,500 | 4,500 | 4,500 |

**Exhibit 3. Capital Budgeting Details for New Manufacturing Process Investment Project**

| | |
|---|---|
| Initial Investment | $8 Million |
| Depreciation | MACRS 7 Year |
| Financing Method | 100% Long-Term Debt |
| First Year Change in Revenue | + $2.5 Million |
| Revenues in Future Years Change At | + 10.0% |
| First Year Change in Expenses | + $500,000 |
| Expenses in Future Years Change At | + 5.0% |
| Cannibalization of Existing Sales | None |
| Project Discount Rate | Current WACC |
| Reinvestment Rate for MIRR | Current WACC |
| Tax Rate | Implied tax rate from Income Statement (Average 2001-2004) |
| Increase in Net Working Capital | $500,000 |
| Expected Economic Life | 10 Years |
| Salvage Value of Equipment in Year 10 | $500,000 |
| Current Beta | 1.25 |
| Expected Market Return | 11.0% |
| Risk-Free Rate | 4.0% |
| Cost of Short-Term Debt | 7.5% |
| Cost of Long-Term Debt | 9.0% |
| Cost of Internal Equity | Calculated per CAPM |

**Exhibit 4. Modified Accelerated Cost Recovery Percentage Depreciation Allowances**

| Year | 5-year | 7-Year | 10-Year |
|---|---|---|---|
| 1 | 20.00% | 14.29% | 10.00% |
| 2 | 32.00% | 24.49% | 18.00% |
| 3 | 19.20% | 17.49% | 14.40% |
| 4 | 11.52% | 12.49% | 11.52% |
| 5 | 11.52% | 8.93% | 9.22% |
| 6 | 5.76% | 8.92% | 7.37% |
| 7 | | 8.93% | 6.55% |
| 8 | | 4.46% | 6.55% |
| 9 | | | 6.56% |
| 10 | | | 6.55% |
| 11 | | | 3.28% |

# MENTOR – MENTEE: A WIN – WIN SITUATION

**William P. Dukes, Texas Tech University**
**Zhuoming "Joe" Peng, Western Oregon University**

*The case illustrates several real financial issues and possible problems that should be addressed by individuals in academia, some of which can involve the tax deferred retirement plan, known as 403B, for those in non-profit organizations such as universities and churches.*

## INTRODUCTION

This case pertains to the relationship between two individuals, the older of which was a faculty member (Jack Pettyjohn) at a doctoral granting institution and the younger (Go Gettum) was a PhD student in the program. The two became friends and, as happens frequently, the two maintained contact after the student had graduated and became a faculty member at another university. In a relatively short time Go and Jack became involved in research. At this time four manuscripts are in various stages of completion, with the hope and desire that all manuscripts will be published along with other projects that are unknown at this time. In addition to academic research, the relationship involves social and business issues.

Historical risk and return data such as that offered by Ibbotson and Associates (*Stocks, Bonds, Bills and Inflation*-SBBI) and *Stocks For The Long Run* by Jeremy Siegel form the basis for many decisions. Asset allocation is important to offset inflation and retain a risk-return balance. There is no single correct answer but there is a call for judgment and reasoning and time required to select quality securities. Each student will be invited to prepare an investment policy statement for Go to cover objectives, constraints, concerns, preferences and asset allocation.

## RELATIONSHIPS

The mentor is Jack Pettyjohn, who was a member of Go Gettum's doctoral dissertation committee. Jack was Go's faculty advisor while Go was in the doctoral program. Go and Jack are involved in a paper from Go's dissertation, along with Robert S. Roebuck, chair of Go's dissertation committee.

Go is in his thirties and single, living in an apartment for which the rent has been increased several times. As is common, Go ran up a fair amount of debt while in graduate school, all of which has been paid off, along with the debt attached to his 2002 Chevy Impala. Go is thrifty and willing to make financial sacrifices at this point in time in order to be able to be comfortable in retirement about 30 years from now.

## RETIREMENT PLAN

Go wants to ensure adequate funds for retirement. His school requires 3 percent of his salary as contribution to his retirement program and contributes 8 percent as matching funds. At this point Go will be sheltering 3 percent of his salary of $82,000 ($2,460) and the university contributes 8 percent ($6,560). In addition, he has arranged to meet the maximum optional contribution to the Supplemental Retirement Annuity of $14,000. Health care expenses and health care premiums are paid for with before-tax dollars. Go elected TIAA-CREF as the retirement plan carrier, with 100 percent of all contributions going to CREF's Equity Index. As part of his retirement plan, Go started a Roth IRA in 2002, and therefore will have $13,000 invested in the Roth IRA after this year's contribution.

In order to ensure the same time period for performance comparison, the year-end of 2004 was used for each of the variable annuities. For CREF variable annuities, the Equity Index reported the highest 10-year return of 11.69%. In a previous performance chart, Equity Index had an estimate of annual expenses (the expense ratio) of 0.44%, with a range for all funds except the money market mutual funds, between 0.44% and 0.69%. The Equity Index's expense ratio of 0.44% matched the lowest available, which includes that of CREF Bond Market and that of Inflation-Linked Bond. TIAA-CREF Institutional Mutual Funds have expense ratios between 0.44% and 0.55% in comparison with Vanguards 500 Index having an expense ratio of 0.18%, and a sector fund Health Care having an expense ratio of 0.28%.

A comparison of CREF performance, to include the original Stock Fund portfolio along with the newer Equity Index, Growth and Global Equities of CREF, will be made using some of Vanguard's equity funds and Fidelity's equity funds, as shown in Exhibit 1 below.

**Exhibit 1. CREF, Fidelity and Vanguard Equity Funds**

| | Inception date | 10-Year Return (%) | Risk | Expense Ratio (%) | Alpha | Turnover (%) |
|---|---|---|---|---|---|---|
| CREF Variable Annuities | | | | | | |
| Stock | 8/1/1952 | 10.47 | -Avg. | 0.48 | 2.13 | 32.2 |
| Global Equities | 5/1/1992 | 8.03 | -Avg. | 0.53 | -4.62 | 95.9 |
| Equity Index | 4/29/1994 | 11.69 | Avg. | 0.44 | .80 | 5.8 |
| Growth | 4/29/1994 | 8.35 | +Avg. | 0.50 | -5.08 | 56.0 |
| Fidelity Investments | | | | | | |
| Low Priced Stocks | 12/27/1989 | 17.83 | Low | 0.97 | 12.81 | 28.0 |
| Sel Defense & Aero | 5/8/1984 | 17.27 | Avg. | 1.24 | 10.92 | 47.0 |
| Sel Medical Equip | 4/28/1998 | 16.14 | Low | 1.15 | 12.07 | 33.0 |
| ContraFund | 5/17/1967 | 13.18 | Low | 0.98 | 7.05 | 67.0 |
| Vanguard Equity Funds | | | | | | |
| Health Care | 5/23/1984 | 20.16 | Low | 0.28 | 4.09 | 13.0 |
| 500 Index | 8/31/1976 | 12.00 | High | 0.18 | -0.11 | 2.0 |
| Primecap | 11/1/1984 | 15.78 | Avg. | 0.46 | 3.46 | 9.0 |
| Windsor II | 6/24/1985 | 13.71 | Avg. | 0.36 | 5.63 | 22.0 |

The data presented in Exhibit 1 generally indicates that the performance of the "variable annuity" funds from CREF appear to be sub-par.

## ROTH IRA

The Roth IRA does not limit investments to variable annuities (of CREF) nor to mutual funds, therefore a comparison could include common stocks as well. As an example the Roth IRA could be made up common stocks of good quality, as shown in Exhibit 2 below. The assumption is made that the price-earnings (*P/E*) ratios will remain the same as the Current *P/E* ratios.

**Exhibit 2. A Possible Five-Stock Portfolio**

| | Value Line Safety | EPS Growth (%) | Yield (%) | Expected Return (%) |
|---|---|---|---|---|
| Stryker (SYK) | 2 | 22.0 | 0.2 | 22.2 |
| Pfizer (PFE) | 1 | 13.5 | 1.9 | 15.4 |
| Kinder Morgan (KMP) | 2 | 10.0 | 6.4 | 16.4 |
| Sysco Corp (SYY) | 1 | 14.5 | 1.7 | 16.2 |
| Cardinal Health (CAH) | 3 | 17.0 | 0.1 | 17.1 |

## HOUSING

Go's full time teaching began in the spring semester of 2002. He rented an apartment with a view of a lake out of the north window. In the spring and summer the view is very nice, but in the winter the view is primarily heavy snow and snow drifts. Go is in his fourth year at Wettown University and has thought about moving to where the climate is less severe. He is living in the same apartment but is somewhat concerned about the rent increasing each year. Go is considering buying a house that would be adequate for him to have his parents live with him. He is thinking about a house in the range of $80,000 to $110,000, preferably two levels that would allow privacy for him and his parents. He would consider a 20-year mortgage.

## ASSIGNMENTS

1. Prepare an investment policy statement for Go to cover objectives, constraints, liquidity, concerns, preferences and asset allocation.

2. What advice appears appropriate for the 403B retirement plan? Demonstrate differences for any comparison. Assume that the plan will run for 30 years, to the time of expected retirement. [*Note: In order to be able to provide advice on the retirement plan, some comparisons would help put the issue into perspective. A total sheltering is limited to*

*$14,000. The part that could help distinguish one group of portfolios from another would be to use the 10-year returns of each of the groups of portfolios to project the expected portfolio value in 10 years*.]

3. What advice would you offer in regard to the Roth IRA? Make comparisons and show the likely value of the Roth in 30 years. What are the advantages of the Roth over the traditional IRA?

4. What housing considerations should be reviewed and, following the review, what recommendation would be appropriate pertaining to housing?

## REFERENCES

**Ibbotson Associates. (2005). *Stocks, Bonds, Bills, and Inflation: 2005 Yearbook*. Chicago: Ibbotson Associates.**

**Siegel, J. J. (1998). *Stocks for the long run*, 2nd edition. New York: McGraw-Hill.**

# SOUTHERN LIFE: DISCOUNTED CASH FLOW, RISK, AND RETURN

**G. R. Cluskey Jr., State University of West Georgia**
**James A. Yoder, State University of West Georgia**

## A PROPOSAL FROM SOUTHERN LIFE

Jennifer Bartimus, CFP, was pleased to hear from her good friend and client, Ronald Hodges. Ron had survived a massive heart attack four years before and was currently receiving disability payments from his former employer's insurance company, Southern Life. Ms. Bartimus reviewed the e-mail that he had sent.

"I need your professional advice on a matter concerning my disability payments. Here's the issue:

Southern Life is currently committed to paying me $2,363.44 on a monthly basis for the next six years until I turn 65 when my disability coverage ends. During the next six years, I will receive total payments of $170,167.68 ($2,363.44/month x 72 months).

Yesterday, one of their many department heads called me. They had concluded that they could be paying me for the entire six years. Apparently, they originally thought I would regain my health and be returning to work. Accordingly, he proposed a buyout in the neighborhood of $73,000 to $75,000. Whoa!

I told him that I wasn't interested but would call him back should I change my mind. He sounded like a con artist selling a payoff for the lottery. Did I do the right thing?"

Jennifer gathered current interest rate data from the *Wall Street Journal* and historical return data on various types of assets from Ibbotson Associates (see Exhibit 1). She knew that she would have to make assumptions; thus, her valuation of the annuity would only be an approximation. Nonetheless, she felt confident that she could tell Ron whether or not the proposed payoff from Southern Life was too low and what a reasonable counter offer would be.

## Exhibit 1
## Historical Return and Current Interest Rate Data

| **Asset Return Data** | **Geometric Average (1926-2002)** |
|---|---|
| Large-Company Stocks | 10.01% |
| Small-Company Stocks | 11.64% |
| Long-Term Government Bonds | 5.38% |
| Yield on six-year U.S. Treasury Notes | 3.50% |
| Yield on 1-10year High-Quality Corp. Bonds | 6.55% |


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