EXPANSION PLANNING AT A PROMINENT CANADIAN INVESTMENT MANAGEMENT FIRM

by

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ABSTRACT

A prominent financial investment firm currently operates offices located in four major cities across Canada. In addition to their current markets, they are seeking to increase their market share of private investors in a number of Canadian cities over a 10-year planning horizon. Expanding their operations to service these new markets would mean either increasing the capacity of their current offices or acquiring additional offices located in new markets, both of which are costly. Thus, a critical decision must be made as to the most cost effective method of expanding their operations to service new markets. Though costs are expected to be greater for a new office location, it is believed that servicing clients from an office located within the prospective city will positively affect revenue growth for the firm. This assumption along with other factors believed to impact revenue growth, such as positive press coverage, are assessed to determine and quantify their potential impact. As advisors' compensation and support are a large component of the costs incurred to service new markets, a hiring strategy of advisors must also be developed for each new market entered. Results from both our scenario analysis tool as well as our analysis on factors affecting revenue growth have given management the information needed to convince shareholders to invest in expansion planning.
Please note that all absolute numbers have been altered within this thesis to adhere to a confidentiality agreement with the financial management firm.

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1. INTRODUCTION

1.1. Company Background

The research for this study was conducted at a prominent Canadian investment management firm with over $30 billion in Assets Under Management and four office locations across Canada. The firm produces it's own suite of mutual funds and provides advisory services to non-profit organizations, institutional clients and private investors. In the early years, the firm solely managed institutional pension plans but has been expanding to provide services to private investors. Their main method of gaining new business is through word of mouth from satisfied clients. Their funds' performances have consistently ranked in the first quartile with notable mentions from leaders in the industry. Today, the firm is known for its long-term performance record, low client fees, and professional counselors.

1.2. Nature of The Mutual Fund Business in Canada

The mutual fund industry was the fastest-growing segment of the financial services sector during the 1990s, with assets increasing from $25 billion in December 1990 to $426 billion by December 2001. For almost every year since 1990, the majority of asset growth has been due to sales. The main types of mutual funds are money market funds, bond funds, equity funds, dividend funds, mortgage funds and real estate funds. In 2001 there were about 1,800 mutual funds in Canada representing over 50 million unit-holder accounts.

The industry is fairly consolidated. From a total of 80 fund management companies operating in Canada, the top 10 companies account for 72 per cent of all assets. At the end of 2001, there were 144 dealer firms involved in the sale of mutual funds and a total of 90,000 people employed in the industry. The industry can generally be divided into the producers and the distributors of mutual funds, although banks and credit unions are involved in both sides of the industry.

Companies involved solely in the production of mutual funds tend to distribute their funds through investment advisors, financial planners, mutual fund dealers and life insurance agents, while the banks and credit unions distribute their fund products through their retail branches as well as through brokers. Producers and distributors earn revenue from three main categories of fees: management fees (to pay for the management of the fund), transaction fees (to pay for buying and selling the fund units) and special fees (for specific administrative costs).

The domestic mutual fund industry is experiencing increasing competition from large foreign firms, with three foreign fund companies (AIM Funds Management Inc., Fidelity Investments Canada Limited and Franklin Templeton Investments Corp.) now managing 20 per cent of mutual fund assets in Canada. Industry analysts expect the mutual fund industry to continue to consolidate as competition intensifies and the manufacturers of mutual funds seek to reduce costs. Table 1.2.1 shows the top 10 companies, in terms of assets, and their percentage of Canadian market share.

Table 1.2.1 Mutual Fund Assets Under Management, December 2001

Company	Assets	Market Share
	($ millions)	(percent)
Investors Group Inc. [1]	41,644	9.8
Royal Mutual Funds Inc.	36,571	8.6
AIM Funds Management Inc.	34,704	8.1
Mackenzie Financial Corporation[1]	33,280	7.8
Fidelity Investments Canada Limited	32,590	7.6
TD Asset Management Inc.	31,925	7.5
AGF Management Limited	28,235	6.6
CIBC Securities Inc.	26,344	6.2
CI Mutual Funds Inc.	21,175	5.0
Franklin Templeton Investments Corp.	19,711	4.6
Total	306,179	71.8
Industry total	426,398	100.0

[1] Investors Group Inc. acquired Mackenzie Financial Corporation in April 2001. However, they remain separate and distinct in their distribution, their investment management operations and their brands.
Source: IFIC.

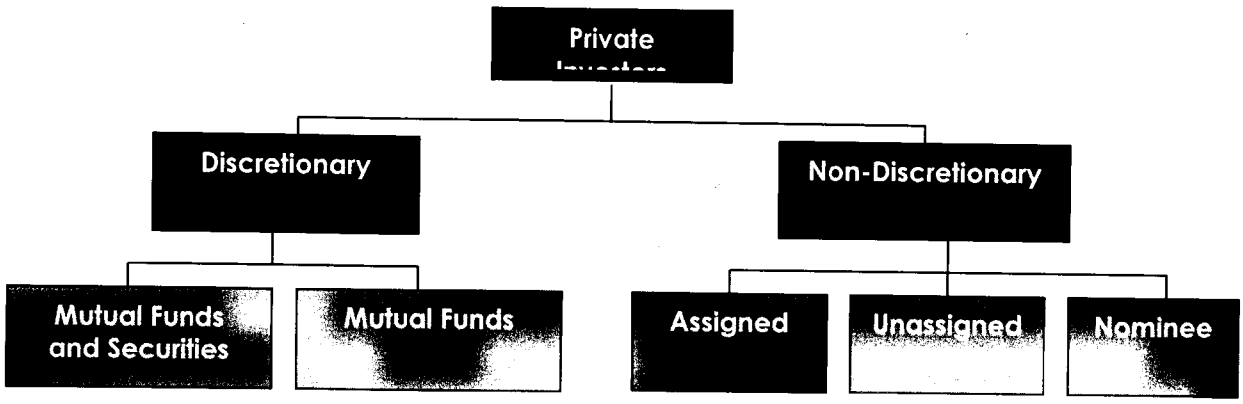
The mutual fund industry in Canada is currently governed by provincial and territorial legislation, which regulate the underwriting, distribution and sale of securities. There is also extensive self-regulation by the Investment Dealers Association of Canada, the Mutual Fund Dealers Association of Canada and the stock exchanges.

1.3. Private Client Structure

Though the firm services non-profit organizations, institutional clients and private investors, our project focuses solely on the Private Client business. The Private Client services are divided into two main offerings: Discretionary and Non-Discretionary services. Discretionary service provides a customer with a one-on-one relationship with a Discretionary Advisor who will make investment decisions on behalf of the client, under specific investment objects determined by the client. A client who opts for Discretionary services has the option to invest solely on the firm's mutual funds or in a combination of funds and securities to further customize his or her portfolio. However, a client must meet a minimum dollar investment level before choosing to invest in a combination of funds and securities.
Non-Discretionary service offers clients several service offerings: Assigned, Unassigned, and Nominee. Assigned clients have a one-on-one relationship with a Non-Discretionary advisor. Unassigned clients (House accounts) do not have a relationship with a Non-Discretionary advisor

but invest in the firm's mutual funds directly with the firm. Nominee clients are clients who invest in the firm's mutual funds but do not purchase them through the firm and instead acquire them through other brokers or dealers. Figure 1.3.1 illustrates the Private Client Structure within the firm.

Figure 1.3.1 The Private Investors Structure



1.4. Project Objective

The objective of this project was to develop a decision support tool for management to enable them to evaluate profit margins of various strategic growth plans over a 10-year planning horizon. This tool would allow management to determine the impact of opening an office in a given city and hiring additional advisors throughout a 10-year period. Our sponsor expressed that this study would be deemed a success if we could "provide management with a usable, scalable, and easy to understand tool" that would enable them to carry out analysis on their own, long after the study terminated.

1.5. Decisions to Be Investigated

The following decisions were to be investigated in our study:

a) Should a new market be serviced out of an existing office or through a new office within the market?

b) How many advisors should be hired and when shall they be hired?

c) Is there an effect on revenue growth due to advisor skill level and marketing ability, and can we quantify this effect?

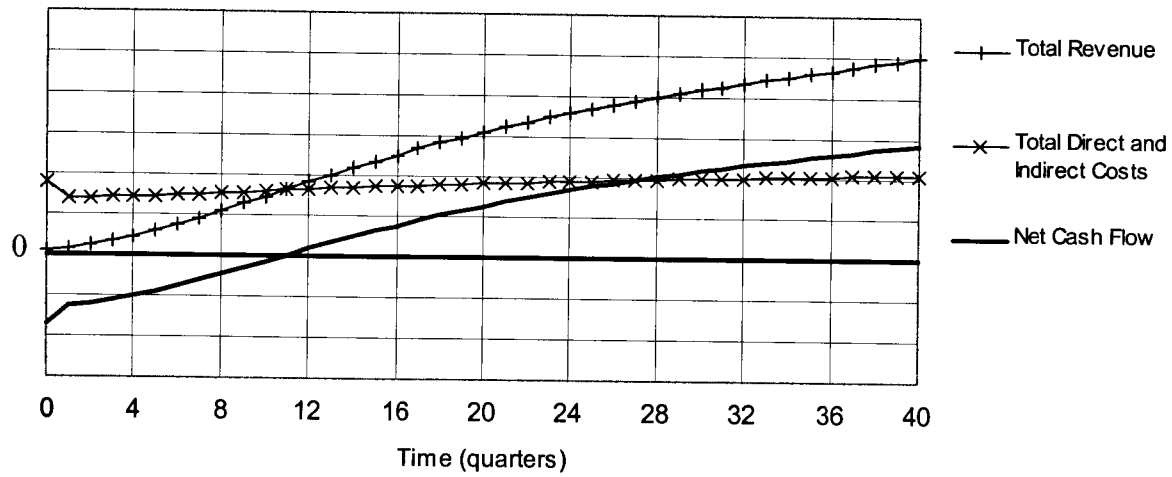
d) Is there an effect on revenue growth for Discretionary and Non-Discretionary advisors due to positive press coverage on the firm?

e) Is there an effect on revenue growth from being present (through a local office) in a new market compared to servicing the new market with advisors who travel to see their clients? If so, can this be quantified?

1.6. Cash Flow Structure

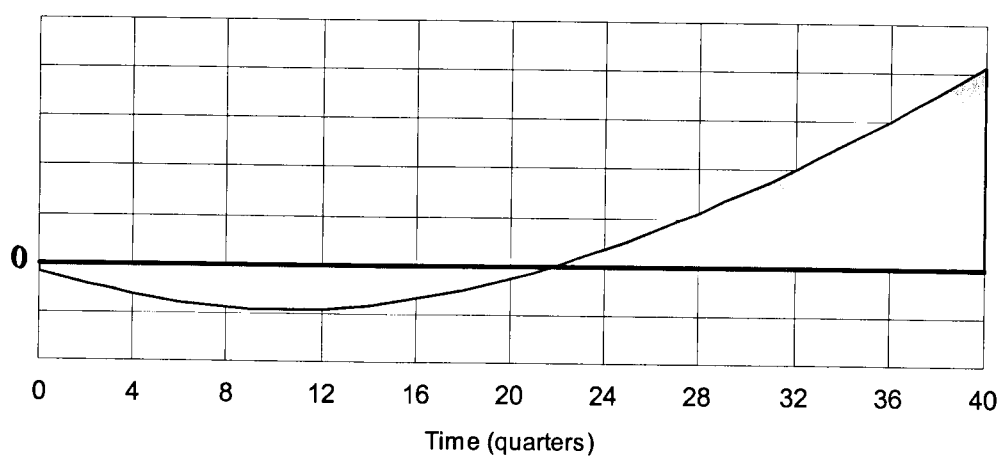
For each expansion, the firm undertakes must meet specific requirements set by their board of directors. The main specification is that a 10-year expansion plan should not result in a maximum negative cash flow of x amount for any quarter of the 10 years. This constrained the number of possible expansion plans according to the value of x. As net cash flow is generated from revenue minus costs, an example of the expected cash flow for each month throughout a 10 year planning horizon in Figure 1.3.2.

Figure 1.6.2 Expected Net Cash Flow for a 10 year Expansion Plan



Here, we see the expected revenues for each quarter along with expected costs for each quarter, and the resulting net cash flows at each quarter. This graph, however, does not show the time when the investment into this expansion plan will breakeven. Thus, Figure 1.6.3 shows the Cumulative Net Cash Flows for each month of the planning horizon.

Figure 1.6.3 Expected Cumulative Net Cash Flow for a 10 year Expansion Plan



In the previous graph, we can see that the investment will break even when the cumulative net cash flow is 0. Thus the investment is expected to become profitable after this point in time.

1.7. Revenue Structure

Although revenue in the mutual fund business is generally composed of management fees, transaction fees, and special administrative fees, the firm's only source of revenue is through management fees. A client's management fee is a percentage of the amount they have invested with the firm. Percentages differ depending on the type of mutual fund the client is investing in. In general, funds containing international securities will have higher fees than funds containing domestic funds. Thus, a client's fee will be a weighted average of the dollar amount invested in a mutual fund and the percentage fee associated with that fund. The firm's management fees have been and continue to be amongst the lowest in the industry.

1.8. Cost Structure

Costs to the firm are generally made up of Advisor's compensation, maintaining trading systems cost, processing transactions cost, and general administrative costs. However, during the company's expansion process, they incur additional costs such as new office costs, which must be modelled when projecting expected future cash flow. This will be discussed further in section 2.

1.9. Literature Review

The topic of capacity expansion has been widely researched for organizations, which have substantial expansion costs with long payout times, and which benefit largely from economies of scale. As our problem lies in the service industry, such expansion costs are generally much smaller and the benefits from economies of scale are considerably less. Traditional capacity expansion problems also tend to focus on the manufacturing or utility industries, which have considerable transportation costs associated with the expansion of their operations. I refer to Shulman (1991) who has developed an algorithm for solving dynamic capacity plant location problems with discrete expansion sizes. Other researchers have focused mainly on static location problem formulations. I refer to Efroymson and Ray (1966), and Geoffrion and McBride (1978). Bienstock and Shapiro (1988) who have developed a stochastic program with recourse to optimize resource acquisition decisions in the electric utility industry. In this paper, Bienstock and Shapiro evaluate acquisitions based on two criteria, how the acquisition will benefit the company over the long-term, and how the acquisition will affect the company in terms of the uncertainty that the new acquisition will create. Thus, they propose a stochastic program with recourse to model possible contingency plans to the realization of each acquisition.

In the service industry, transportation costs are minimal for making expansion decision, while other issues such as meeting fluctuations in demand are more difficult to deal with due to the service industry's lack of ability to store inventories to meet these fluctuations. I refer to Berman, Ganz, and Wagner (1994) who have formulated a stochastic optimization model for

planning capacity expansion for a service industry, which incorporates uncertainty of future demand. They develop a weighted set of possible demand scenarios in a stochastic optimization model, which determines a schedule for expanding capacity. The solution provides the size, location and timing of each expansion to maximize the companies expected profit. Using Lagrangian relaxation and taking advantage of the special nested knapsack structure of the sub-problems, they developed an algorithm to solve this specific problem.

We opted for a simpler model to assist management, as pursuing a stochastic optimization model would force the firm to hire additional employees and new software to support the model. We developed a scenario tool in Microsoft Excel, which would simulate possible expansion plans for a given city. This would allow transparency and usability to the model for persons without the knowledge of stochastic optimization models.

2. ANALYSIS METHODOLOGY

2.1. Solution Approach

We began the study by discussing potential differences between the Discretionary and Non-Discretionary services. This allowed us to determine the feasibility of building a profitability analysis model incorporating both businesses. We analyzed differences in cost, revenue and business processes for maintaining each level of service. This was accomplished by working with the Chief Financial Officer, the Vice Presidents of the Discretionary and Non-Discretionary services, and an Associate in Discretionary Services. Through interviews with several Discretionary and Non-Discretionary Advisors, process maps were developed to better understand the flow of clients into the firm. Flow charts are included in appendix A. Once potential differences were highlighted, we determined that differences among the groups did not warrant creating separate profitability model for each type of service.

We began by developing models to estimate expected revenue growth and costs projected over a 10-year horizon. We then sought to quantify assumptions made by upper management regarding the impact of factors believed to affected revenue growth. Thus, factors such as positive press coverage, and proximity of the advisor with respect to their clients were analyzed. Once these parameters were estimated, they could, in combination with the revenue and cost model, be incorporated into a profitability model, which would be developed in Microsoft Excel. This particular platform was chosen due to its presence in the firm, its transparency, and its user-friendly logic.

The following outlines the major outcomes of this study.

1. *Process Maps* – Process maps were developed for the acquisition and maintenance of Discretionary and Non-Discretionary Advisors
2. *Expected revenue growth models* – separate models were developed for the Discretionary and Non-Discretionary advisors to reflect different growth natures
3. *Analysis on factors affecting revenue growth* – advisor skill level and marketing ability, positive press coverage, and proximity effect were analyzed to quantify their effect on revenue growth
4. *Expected Cost model* – separate models were developed for the Discretionary and Non-Discretionary advisors based on figures from the firms Activity Based Costing analysis
5. *Expected Profitability Model* – a profitability model was developed to reflect the expect cash flows over a 10-year horizon by incorporating the revenue and cost models as well as parameters for effects of advisor skill, marketing ability, positive press coverage, and proximity effect.
6. *Scenario Analysis Tool* – a scenario analysis tool automated the profitability model to analyze hundreds of expansion strategies, allow the user to optimize on one of several criteria and receive sensitivity analysis on the optimal expansion plan

2.2. Cumulative Net Contribution Growth Models

As revenue is a percentage of the accumulated Net Contributions/Book Value for each advisor, we needed to model Book Value growth per advisor in order to obtain estimates of revenue. This was quite challenging, as the firm had never previously queried this data from their systems. The firm currently only keeps reports on an advisor's current Assets Under Management. Thus, they do not keep historical reports on either Assets Under Management or Book Value for each advisor. Therefore, we looked to their transactional records to create data on historical advisor Book Value for our analysis.

Analysts from the firm queried two flat files from their data warehouse, one pertaining to the historical transactions of an investor and the other to the *current* residential address of the investor[1]. Data was only available from October 1998 to May 2002. Table 2.2.1 and 2.2.2 shows a sample of the transactional file and the investor location file used in our analysis. Table 2.2.2 shows a sample of the resulting flat file after processing the data for use in our models.

Table 2.2.1 Transactional File Sample Data

Investor No	Date	Market Value	Cash Flow	Dealer Code	Dealer Rep Code	Dealer Count
1123	082000	1,234,567	234,567	300	12	1
1123	092000	1,624,357	-10,000	300	12	1
1123	102000	1,623,333	1,000	300	12	1

a) *Investor No* – A unique investor number is assigned for each client. This number is used in processing transactions on their accounts with the firm.

b) *Date* – The month and year when the transactions took place.

c) *Market Value* – The current market value of the portfolio. Market value is also known as Assets Under Management. This value incorporates the contributions by the investor, switches between accounts, as well as the market growth of the portfolio

d) *Cash Flow* – The net amount of cash into the portfolio. Total buys minus total sells of all accounts within a portfolio during a month.

e) *Dealer Code* – The financial institution in which the client makes the transaction.

f) *Dealer Rep Code* – The Advisor who carries out the transaction.

g) *Dealer Count* – The number of Advisors who have made transactions for the client in a given month.

[1] Current data was used in this study as no historical client locations were kept in their data warehouse.

Table 2.2.2 Client Location Sample Data

Investor No	City	Province Code	Postal Code	Country Code
1123	Toronto	ON	L5M 4J2	Canada
1124	Vancouver	BC	V6T 4M3	Canada
1125	Calgary	AB	T2L 4M8	Canada

a) *Investor No* – A unique investor number is assigned for each client. This number is used to make transactions on their many accounts with the firm.

b) *City* – The client's current mailing address city as of May 2002

c) *Province Code* – The client's current mailing address province as of May 2002

d) *Postal Code* – The client's current mailing address postal code as of May 2002

e) *Country Code* – The client's current mailing address country as of May 2002

A new file was created by merging the client transaction file with the client location file. A new variable, Cumulative Net Contributions, was calculated in order to model revenue growth. A definition is provided below as well as a description of how it was created.

a) *Cumulative Net Contribution (CNC)* – The total accumulated Net Contributions of a client's portfolio aggregated by advisors from when they began with the firm. As data is only available from October 1998, Net Contributions of advisors who started working with the firm before October 1998 needed to be estimated. This was accomplished by taking a percentage of the Assets Under Management at October 1998 to represent the Cumulative Net Contributions up until this date.

Since the growth of an advisor's Book Value was dependent on the time the advisor was hired, a time variable was created to represent the amount of time the advisor had been with the firm, in months. Thus, each advisors growth pattern of Cumulative Net Contribution was plotted against their time with the firm in order to determine whether their existed similar patterns in growth amongst the advisors.

From initial plots of Cumulative Net Contribution for the Non-Discretionary and Discretionary advisors, it was observed that the Non-Discretionary advisors growth pattern followed a linear shape, whereas the Discretionary advisors followed a non-linear shape. This distinction prompted us to develop separate growth models for the Non-Discretionary and Discretionary advisors.

In our analysis, several discretionary and non-discretionary advisors were identified as outliers due to their unusual growth. They were eliminated from our analysis as further reconciliation with members of the firm validated our observation. It was found that these advisors either were part time advisors or were retiring and thus, had been giving away large amounts of their Assets Under Management to other advisors in the firm.

All Non-Discretionary advisors Cumulative Net Contributions growth curves are shown in Figure 2.2.1. All Discretionary advisors who were used in fitting Cumulative Net Contributions growth are shown in Figure 2.2.2. All Discretionary advisors Cumulative Net Contributions growth curves are shown in Figure 2.2.3. Similarly, all Discretionary advisors who were used in fitting Cumulative Net Contributions growth are shown in Figure 2.2.4. The legend on the right-hand- side shows each advisors growth. Each advisor is labelled with a number to protect the advisors confidentiality.

Figure 2.2.1 All Non-Discretionary Advisors Cumulative Net Contributions

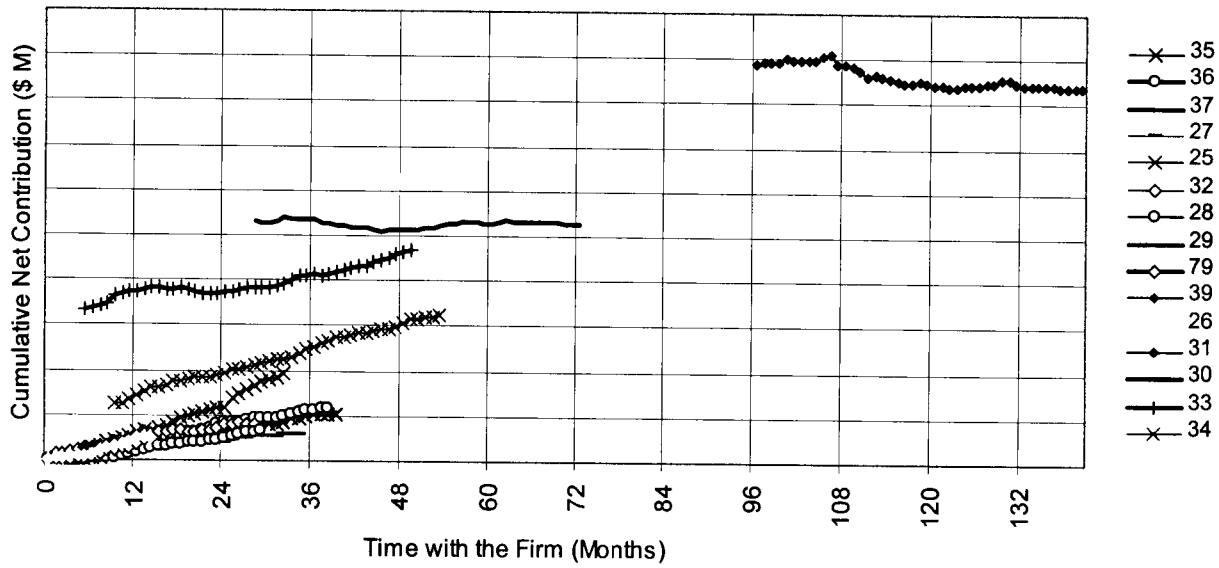


Figure 2.2.2 All Modelled Non-Discretionary Advisors Cumulative Net Contributions

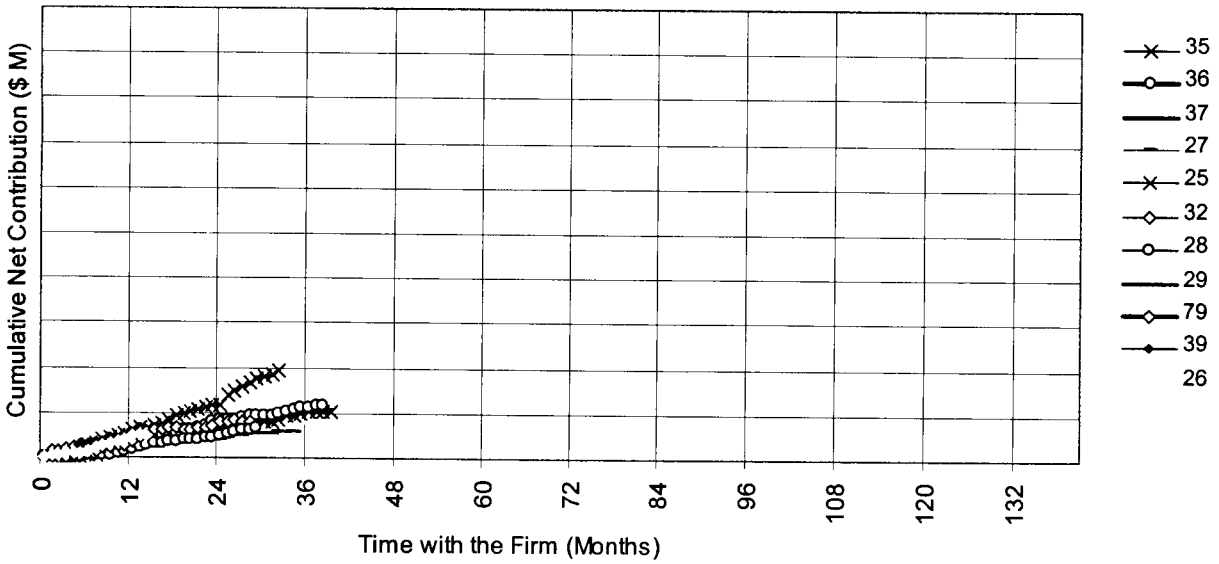


Figure 2.2.3 All Discretionary Advisors Cumulative Net Contributions

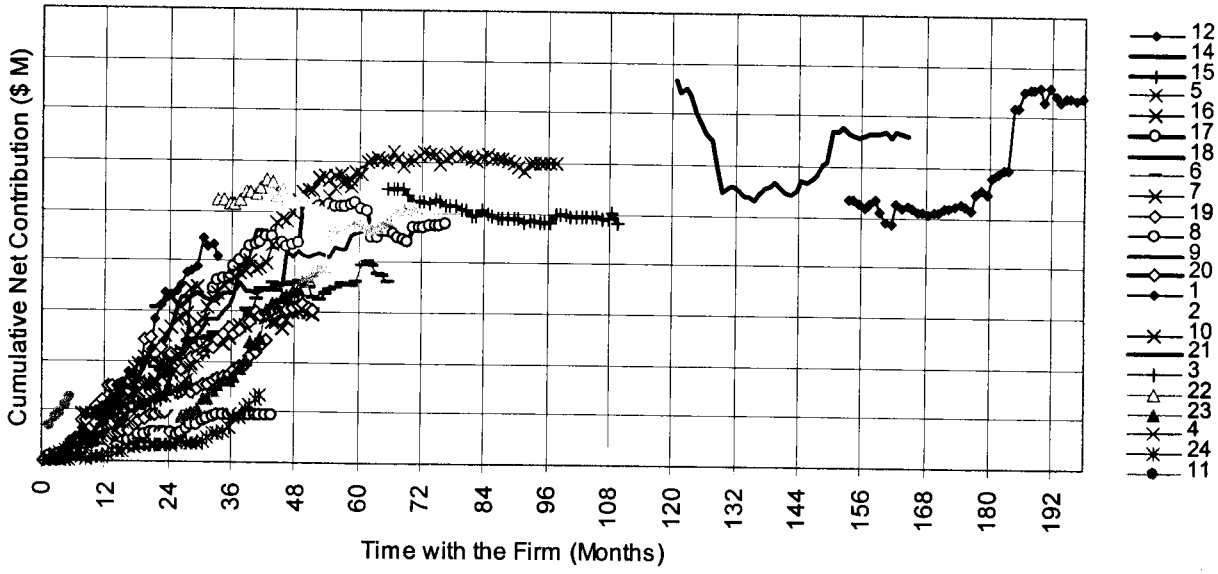
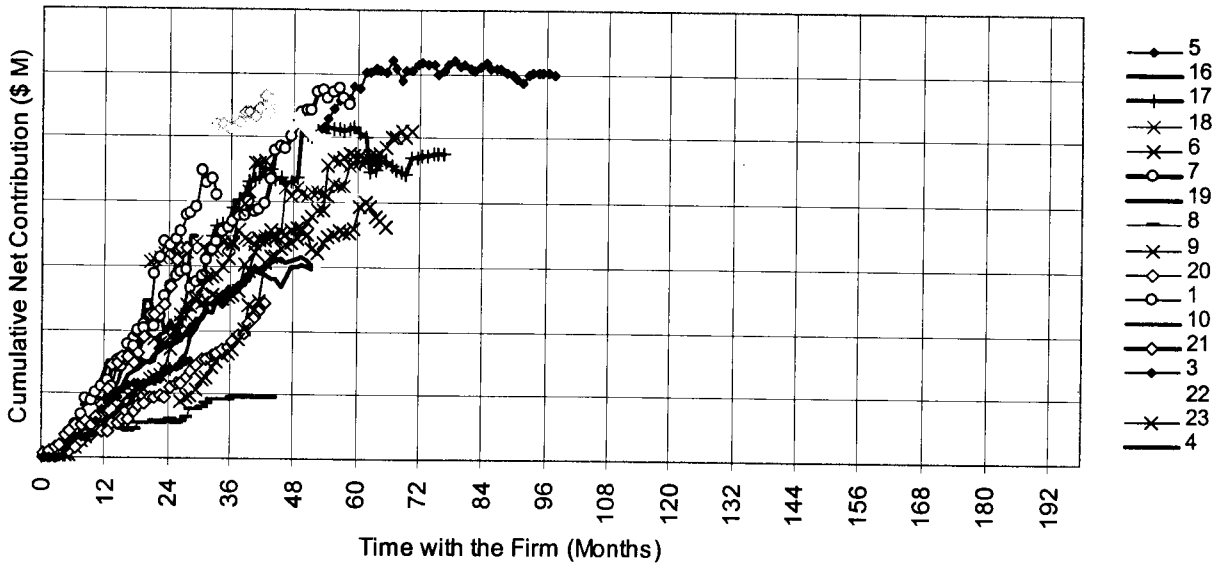


Figure 2.2.4 All Modelled Discretionary Advisors Cumulative Net Contributions



Non-Discretionary Advisors

As the Non-Discretionary advisor's growth followed a linear pattern, a simple linear regression model was used to model growth of Cumulative Net Contribution with a single independent variable, amount of time the advisor has been with the firm as an advisor. No intercept was included into the model as it is customary for an advisor to begin the growth of their book with no clients. Equation (2.2.1) shows the linear model used to estimate Non-Discretionary book growth.

$$Y = \beta_1 x + \varepsilon \tag{2.2.1}$$

Where,

Y = Cumulative Net Contribution

x = Amount of time the Advisor has spent growing their book (months)

β_1 = Effect on Cumulative Net Contribution due to amount of time the advisor is with the firm

ε = Unexplained variance

For each Advisor, we obtained monthly totals of Cumulative Net Contributions for the each month the advisor has been working with the firm. As data was only available from October 1998, to May 2002, the number of observations used for each advisor in the model was dependant on when the advisor was hired. Therefore, approximately 30 data points for each advisor was used in the linear regression model. In order to fit the model we treated each advisor data point independently form one another. The regression model was created in SAS, as statistical software program, using each of the monthly Cumulative Net Contributions for every advisor independently. The following hypothesis test was performed to determine whether x was a significant predictor of Y. A result was noted as significant if its P-value based on a t-test was less than 0.05.

Discretionary Advisors

As with the Non-Discretionary advisors, Cumulative Net Contributions for each advisor, on a monthly basis was calculated and used to model Book Value growth. For the same reasons, noted for the Non-Discretionary advisors, only approximately 30 data points were used in the modelling of Discretionary advisors. Every Discretionary advisors monthly data that was available was used to fit the model. As the growth of Discretionary advisor Book Value did not follow a linear pattern, and instead showed a characteristic Sigmoidal growth curve, a Sigmoidal Non-Linear growth model was used to model the Discretionary advisors book growth. We tested the fits of several 3 and 4 parameter, non-linear growth models and chose to model book growth using a four parameter Non-linear model as it allowed greater flexibility to the fit compared to a 3 parameter model. More specifically a 4-parameter, Weibull model was used to fit the growth curve. The Weibull model function is included in (2.2.2).

$$Y = \alpha - \beta \exp(-\gamma x^{\delta}) + \varepsilon \tag{2.2.2}$$

Where,

Y = Cumulative Net Contribution / Book Value
x = Amount of time the Advisor has spent growing their book (months)
α = Asymptote
$\alpha - \beta$ = intercept on the Y-axis (initial value of Y)
γ = rate at which the response changes from its "initial value"
δ = rate at which the response changes from its "initial value"
ε = Unexplained variance

The following steps outline how a fit was developed:

1. Obtain initial parameter estimates of α, β, γ, δ
2. Obtain convergence of parameter estimates
3. Fit the model

Obtain Initial Parameter Estimates

Initial parameter estimates of α, β are obtained by graphing Y versus x. α_0 is obtained by estimating the approximate maximum value approached by the response Y as X approaches infinity.

For low values of x, an estimate of the ordinate intercept Y_{INT} can be estimated with a value corresponding to x=0. From α_0 and Y_{INT}, an estimate of β_0 is obtained as

$$\beta_0 = \alpha_0 - Y_{INT} \tag{2.2.3}$$

By rearranging (2.3) we obtained,

$$z_0 = \log\left[-\log\left(\frac{\alpha_0 - Y}{\beta_0}\right)\right] = \log\gamma + \delta\log X \tag{2.2.4}$$

Performing a simple linear regression of Z_0 on $\log X$ enables estimates of $\log\gamma$ and δ_0.

Obtain Convergence of Parameter Estimates

Once initial estimates are obtained, the Gauss-Newton method can be used to find convergence of parameter estimates. The Gauss-Newton method is not included in this document but can be found in the Ratkowsky (1983).

Fit the model

Once parameters have converged, the model can be estimated. The final estimated parameters for the model using all the data were:

$\hat{\alpha}$ = 183,000,000 $\qquad$ $\log\hat{\gamma}$ = -5.899303

$\hat{\beta}$ = 183,000,000 $\qquad$ $\hat{\delta}$ = 1.553743

All estimations and tests are performed in, SAS, a statistical software package using the 'proc model' statement. In addition to the effect of time on the growth of an advisors book, Management was also interested in the effects of location, advisor skill and marketing ability. In the next sections we outline the methodology used to test for these effects. As there are very few advisors, one large model could not be used to determine the interaction effects of the variables.

2.3. Location Effect on Growth of Cumulative Net Contributions

Management wanted to determine whether there were significant differences in the book growth of advisors from different office locations. To test differences among advisors from the Vancouver, Toronto, and Calgary offices, linear and non-linear models, with indicator variables, were created for the Discretionary and Non-Discretionary Advisors, respectively. These indicator variables allow the model to distinguish the data by location.

Non-Discretionary Advisors

To test for location effects on Cumulative Net Contribution growth, we expand model (2.2.1) to include indicator variables for location. The proposed linear model is shown in (2.2.5). As noted in section 2.2, no intercept is included in the model as it is assumed that an advisor begins with no clients.

$$Y = \beta_1 x + \beta_2 (a_1 * x) + \beta_3 (a_2 * x) + \varepsilon \qquad (2.2.5)$$

where,

Y = Cumulative Net Contribution / Book Value

x = Amount of time the Advisor has spent growing their book (months)

$$a_1 = \begin{cases} 0, & \text{Vancouver Advisor} \\ 1, & \text{Toronto Advisor} \end{cases}$$

$$a_2 = \begin{cases} 0, & \text{Vancouver Advisor} \\ 1, & \text{Calgary Advisor} \end{cases}$$

β_1 = Effect on Cumulative Net Contribution due to amount of time with the firm

β_2 = Effect on Cumulative Net Contribution due to Toronto Location

β_3 = Effect on Cumulative Net Contribution due to Calgary Location

ε = Unexplained variance

The following hypothesis tests were performed to determine significant differences in revenue growth among advisors from each location.

Ho: $\beta_2 = 0$, Toronto advisors growth rates *do not* differ from Vancouver advisors

Ha: $\beta_2 \neq 0$, Toronto advisors growth rates *do* differ from Vancouver advisors

Ho: $\beta 3 = 0$, Calgary advisors growth rates do not differ from Vancouver advisors

Ha: $\beta 3 \neq 0$, Calgary advisors growth rates do differ from Vancouver advisors

T-tests were performed and significance of theses hypotheses was determined from the resulting P-values from Wald's test. If the resulting P-value is less than 0.05, the null hypothesis would not be rejected.

Ho: $\beta 2 = \beta 3$, Toronto advisors do not differ from Calgary advisors
Ha: $\beta 2 \neq \beta 3$, Toronto advisors do differ from Calgary advisors

Residual analysis was then conducted on the final model to ensure the assumptions of normality and independence are not violated.

Discretionary Advisors
To test for differences in Book Value growth among advisors from different locations, a four-parameter Weibull model, with indicator variables on parameter γ, is proposed. Normal business practices require a Discretionary advisor to reach approximate capacity at 229,000,000 Assets Under Management over a 5-year period. However, as our model focuses on Book Value we need to define a capacity constraint on Book Value growth. As Assets Under Management is defined as Cumulative Net Contributions with added market growth, plus transferred assets from other advisor, we proposed a capacity constraint of 183,000,000 for Book Value growth. Our proposed value was also in line with management's expectations. Thus, this value was used to estimate the asymptote variable, α.

As an advisor normally begins with an empty book, the initial starting parameter, $\alpha - \beta$, is set equal to 0. We hold α and β constant while we fit parameters γ, and δ. Ideally, we would want to test changes in α (the maximum value) as well as γ (the initial rate of change from the starting value). However, there did not exist enough data, near to the asymptotic value, to model. This was shown in the results of our preliminary fitted models, which estimated α well over 213,000,000. As this was the case, we propose to model changes in γ only. Thus, (2.6) shows the Weibull model tested in our analysis.

$$Y = 183{,}000{,}000 - 183{,}000{,}000 \exp(-\gamma + \beta_1 a_1 + \beta_2 a_2)\ x^{\delta} + \varepsilon \qquad (2.2.6)$$

Where,

Y = Cumulative Net Contribution / Book Value
x = Amount of time the Advisor has spent growing their book (months)

$$a_1 = \begin{cases} 0, & \text{Vancouver Advisor} \\ 1, & \text{Toronto Advisor} \end{cases}$$

$$a_2 = \begin{cases} 0, & \text{Vancouver Advisor} \\ 1, & \text{Calgary Advisor} \end{cases}$$

β_1 = Effect on initial growth rate, parameter γ, due to Toronto Location
β_2 = Effect on initial growth rate, parameter γ, due to Calgary Location
ε = Unexplained variance

The following hypotheses tests were performed to determine statistical significance among initial revenue growth rate of advisors at each office location.

Ho: $\beta_1 = 0$, Toronto advisors growth rates *do not* differ from Vancouver advisors
Ha: $\beta_1 \neq 0$, Toronto advisors growth rates *do* differ from Vancouver advisors

Ho: $\beta_2 = 0$, Calgary advisors growth rates *do not* differ from Vancouver advisors
Ha: $\beta_2 \neq 0$, Calgary advisors growth rates *do* differ from Vancouver advisors

Appropriate T-tests were performed and statistical significance was concluded if the P-value resulting from the T-test was less than 0.05. Parameter estimates were also analyzed to determine magnitude of effect.

Ho: $\beta_1 = \beta_2$, Toronto advisors growth rates *do not* differ from Calgary advisors
Ha: $\beta_1 \neq \beta_2$, Toronto advisors growth rates *do* differ from Calgary advisors

Similar to the Non-Discretionary analysis, Wald's test statistic was used to determine significance of each hypothesis.

2.4. Marketing Effect on Growth of Cumulative Net Contributions

The firm wanted to determine whether advisors who proactively marketed for new clients showed an increased rate of growth in Net Contributions compared to advisors who did not actively seek out new clients. The firm's management separated their advisors into 2 categories of marketing ability: Reactive marketer and Proactive marketer. Reactive marketers generally do not make cold calls or conduct information sessions. They generally acquire new clients from their existing clients, other advisors, or through the firm's contact centre, where general inquiries are handled. One the other hand, a Proactive advisor is known to actively seek our new clients, through contacts with accountants and other business professionals; information sessions, and cold calling. A similar methodology was used to test for differences in advisor growth rate between the two marketing styles as was used in section 2.3.

Non-Discretionary Advisors
To test for differences in growth rates among Non-Discretionary Advisors, a linear regression model with indicator variables was used to test for effect of proactive marketing. The proposed linear model is an extension of model 2.1 and is shown in (2.7).

$$Y = \beta_1 x + \beta_2 m_1 x + \varepsilon \qquad (2.2.7)$$

Where,

Y = Cumulative Net Contribution / Book Value
x = Amount of time the Advisor has spent growing their book (months)

$$m_1 = \begin{cases} 0, & \text{Reactive Advisor} \\ 1, & \text{Proactive Advisor} \end{cases}$$

β_1 = Effect on Cumulative Net Contribution due to the amount of time the advisor is with the firm
β_2 = Effect on Cumulative Net Contribution due to proactive marketing
ε = Unexplained variance

The following tests were created to assess for significant differences among the Proactive and Reactive advisors.

Ho: $\beta_2 = 0$, Proactive marketing *does not* affect Book Value growth
Ha: $\beta_2 \neq 0$, Proactive marketing *does* affect Book Value growth

T-tests were performed and statistical significance was concluded if the P-value resulting from the T-test was less than 0.05. Parameter estimates were also analyzed to determine magnitude of the effect. Residual analysis was not conducted on model (2.2.7) and should be conducted in further research.

Discretionary Advisors
To test whether proactive marketing activity affected the growth rate of advisor Book Value, we performed T-tests on the parameter γ in the Weibull curve. Thereby determining the significance on the initial rate of Book Value growth between the two marketing styles. The Weibull model used in this analysis is shown in (2.2.8).

$$Y = 183{,}000{,}000 - 183{,}000{,}000 \exp(-\gamma + \beta_1 m_1)\ x^{\delta} + \varepsilon \qquad (2.2.8)$$

Where,

Y = Cumulative Net Contribution / Book Value
x = Amount of time the Advisor has spent growing their book (months)

$$m_1 = \begin{cases} 0, & \text{Reactive advisor} \\ 1, & \text{Proactive advisor} \end{cases}$$

β_1 = Effect on parameter γ due to proactive marketing
ε = Unexplained variance

The following test was performed to determine whether proactive marketing had a significant effect on the initial growth rate, γ, of advisor Book Value.

Ho: $\beta_1 = 0$, Proactive marketing *does not* affect on initial Book Value growth rate
Ha: $\beta_1 \neq 0$, Proactive marketing *does* affect on initial Book Value growth rate

Statistical significance was concluded if the P-value resulting from the T-test was less than 0.05. Parameter estimates were also analyzed to determine magnitude of effect of proactive marketing.

2.5. Advisor Skill Level Effect on Growth of Cumulative Net Contributions

The firm's management sought to quantify differences in Book Value growth among advisors who, in their opinion, possessed different skill levels. Management used subjective judgment to categorize their advisors into three categories for Skill (0=Low Skill level, 1=Medium Skill level, 2=High Skill level). Low Skilled advisors are advisors who have performed worse, in comparison to their peers, in the past, or advisors who have not been with the firm long enough for their ability to be determined. Medium Skilled advisors describe those who have performed well, however, inconsistently in the past High Skilled advisors describe those who have performed above average on a consistent basis, in comparison to their peers.

Non-Discretionary Advisors

For the Non-Discretionary advisors, we used a linear model with indicator variables to categorize advisors by skill level. We then tested for significance between advisor skill levels. As advisors generally begin growing their book with no initial clients, no intercept parameter is needed in the model. Thus, interaction effects are only included to test for differences in book growth among different skilled advisors. The model is shown in (2.2.9).

$$Y = \beta_1 x + \beta_2 s_1 x + \beta_3 s_2 x + \varepsilon \qquad (2.2.9)$$

Where,

Y = Cumulative Net Contribution / Book Value

x = Amount of time the advisor has spent growing their book (months)

$$s_1 = \begin{cases} 0, & \text{Low Skilled advisor} \\ 1, & \text{High Skilled advisor} \end{cases}$$

$$s_2 = \begin{cases} 0, & \text{Low Skilled advisor} \\ 1, & \text{Medium Skilled advisor} \end{cases}$$

β_1 = Effect on Cumulative Net Contribution due to the amount of time with the firm

β_2 = Effect on Cumulative Net Contribution due to being High Skilled

β_3 = Effect on Cumulative Net Contribution due to being Medium Skilled

ε = Unexplained variance

The following tests were performed to assess for significant differences among the rated advisors. Wald's test statistic was used to determine the significance of each hypothesis.

Ho: $\beta_2 = 0$, High Skilled advisors growth rate *does not* differ from low skilled advisors
Ha: $\beta_2 \neq 0$, High Skilled advisors growth rate *does* differ from low skilled advisors

Ho: $\beta_3 = 0$, Medium Skilled advisors growth rate *does not* differ from low skilled advisors
Ha: $\beta_3 \neq 0$, Medium Skilled advisors growth rate *does* differ from low skilled advisors

Ho: $\beta_2 = \beta_3$, High Skilled advisors growth rate *does not* differ from medium skilled advisors
Ha: $\beta_2 \neq \beta_3$, High Skilled advisors growth rate *does* differ from medium skilled advisors

Discretionary Advisors

For the Discretionary advisors, non-linear Weibull models, with indicator variables, were used to model the effect of skill level on initial rate of growth of Cumulative Net Contributions. Thus, only tests on parameter γ are conducted. The model used in our analysis is shown in (2.2.10).

$$Y = 183{,}000{,}000 - 183{,}000{,}000 \exp(-\gamma + \beta_1 s1 + \beta_2 s2)\ x^{\delta} + \varepsilon \qquad (2.2.10)$$

Where,

Y = Cumulative Net Contribution / Book Value

x = Amount of time the Advisor has spent growing their book (months)

$$s_1 = \begin{cases} 0, & \text{Low Skilled Advisor} \\ 1, & \text{High Skilled Advisor} \end{cases}$$

$$s_2 = \begin{cases} 0, & \text{Low Skilled Advisor} \\ 1, & \text{Medium Skilled Advisor} \end{cases}$$

β_1 = Effect on parameter γ due to a High Skilled advisor

β_2 = Effect on parameter γ due to a Medium Skilled advisor

ε = Unexplained variance

We performed the following tests to compare High and medium skilled advisors to Low advisors and then compared high to medium skilled advisors.

Ho: $\beta_1 = 0$, High Skilled advisors growth rate *does not* differ from low skilled advisors
Ha: $\beta_1 \neq 0$, High Skilled advisors growth rate *does* differ from low skilled advisors

Ho: $\beta_2 = 0$, Medium Skilled advisors growth rate *does not* differ from low skilled advisors
Ha: $\beta_2 \neq 0$, Medium Skilled advisors growth rate *does* differ from low skilled advisors

The P-values from T-tests were used to determine significance of these hypotheses. Parameter estimates were also analyzed to determine magnitude of effect of high and medium skill level.

Ho: $\beta_1 = \beta_2$, High Skilled advisors growth rate *does not* differ from medium skilled advisors
Ha: $\beta_1 \neq \beta_2$, High Skilled advisors growth rate *does* differ from medium skilled advisors

Wald's test of significance was used to determine differences in initial growth rate between high and medium rated advisors. Statistical significance was concluded if the P-value resulting from a T-test was less than 0.05.

2.6. Financial Press Coverage Effect on Average Net Contributions

Management wanted to quantify the effect of positive coverage in financial publications on the amount of Net Contributions accumulated by each advisor. Table 2.6.1 shows the list of events,

which were analyzed. Analysis was broken down into Discretionary and Non-Discretionary clients (Assigned and Unassigned). Assigned clients were then further broken down by location of advisor (Vancouver, Toronto, or Calgary). Unassigned clients were however, broken down by client location (Vancouver, Toronto, or Calgary). Event 1 refers to coverage in a Canadian Mutual Funds buyer guide published yearly. Event 2 corresponds to a notable mention in a nationally distributed Canadian newspaper and Events3 and 4 refers to articles in a nationally distributed Canadian financial magazine.

Table 2.6.1 Positive Press Events on the Firm

Event	Date
Positive Event 1	November 1999
Positive Event 2	January 2001
Positive Event 3	November 2001
Positive Event 4	December 2001

Note: As Event 3 and event 4 occur relatively close to each other, they are modelled as 1 event.

As new advisors were hired between these events, our analysis focused on Average Net Contributions per advisor to eliminate the effect an additional new advisor would have on the event in question. Therefore, Net Contributions were calculated for each advisor for each month from the period between October 1998 and May 2002. T-tests were performed and based on the resulting P-values a determination was made as to whether there was a change in Average Net Contributions one and a half years before and six months following the event. In cases where there were not enough data points, prior to the event, to obtain a one and a half year sample, we simply used the data that was available for our sample.

Since Non-Discretionary clients do not have a relationship with an advisor, Average Net Contributions per advisor could not be calculated. Instead, Total Net Contributions of all clients were calculated and assessed to determine changes before and after an event. As with the Discretionary analysis, data one and a half years prior to the event and six months after the event was used for analysis. T-tests were performed and used to determine statistically significant changes in total Net Contributions. The Average Net Contribution per client was not analyzed, as the statistic would not have accounted for new clients joining the firm.

2.7. Proximity Effect on Average Net Contributions

Determining whether physical presence in a given market affected the average accumulated Net Contributions for each advisor was critical, as one of our main decisions involved whether to open an office in a new market. Therefore, a trade off between the extra cost of the new office and expected revenue growth from that new office, had to exist if we were to recommend opening an office in the new market.

Determining whether the physical presence in the new market, through a local office, influenced the growth of Average Net Contributions per advisor for both the Discretionary and Non-

Discretionary services was key. We compared the Average Net Contributions of the Calgary clients before and after opening the Calgary office. This office was chosen because data on advisor growth was available before and after the opening of the office, in November 1999.

For the Discretionary analysis, the firm's management had four Vancouver advisors assigned to seek out Calgary clients prior to opening the Calgary office, although these advisors were also responsible for managing Vancouver clients. Thus, each assigned advisor represented the growth rate of a part time Vancouver advisor devoted to managing Calgary clients.

Thus, only the four Discretionary advisors were compared and analyzed against the Calgary advisors. Their Average Net Contributions were calculated for each month between October 1998 and May 2002. As Discretionary managers have a non-linear growth curve, we would expect a non-linear increase in Net Contributions following the opening of the Calgary office, due to the new hired advisors. This presented a challenge, as the assumption of constant variance was violated. To adjust for this, we performed a two-sample t-test with unequal variance, using Satterthwaite's approximation (Steel and Torrie, 1980) for calculating the degrees of freedom.

For Non-Discretionary advisors, there is no problem with non-constant variance and therefore a t-test was performed to test for changes in Average Net Contributions before and after the new office. One must note that the Non-Discretionary advisors were not specifically assigned to acquire Calgary clients.

Residual analysis was then conducted on the final model to ensure assumptions of normality and independence were not violated.

2.8. Cost Model

Data for modelling cost was obtained from the firms Activity Based Costing analysis. The Activity Based Costs were separated into Direct Advisor Costs, Indirect Advisor Costs, and Fixed Business Costs. Direct costs were defined as costs that could be directly traced back to each advisor. Indirect costs were defined as costs such as processing transactions, and administrative costs, which could not be directly traced back to each advisor, but were instead divided among all the advisors. Fixed costs were defined as costs, which are incurred regardless of the number of advisors hired. For example, the costs of researching investments for the firms mutual funds remain the same whether they hire 1 or 10 discretionary advisors.

Table 2.8.1 to 2.8.3 lists the Activity Based Costs in each category. Aside from the normal business costs, costs for opening a new branch office were also estimated. These costs are outlined in Table 2.8.4.

Table 2.8.1 Direct Advisor Costs

Direct Advisor Costs	Indirect Advisor Costs	Fixed Business Costs
Advisor Salary	Maintain client systems	Economic Research
Advisor benefits	Maintain PCs	Researching Investments
Assistant salary	Maintain the Network	Web Site
Assistant benefits	Professional Memberships	Corporate Communication
(Travel costs)	Mail and Office Supplies	Maintaining Strategy
	Courier and Postage	Maintaining Compliance
	Trading Losses	Maintaining People
	Registrations, Licences, and Fees	Vintage Fund
	Processing Costs	MMF Fees
	Overall Corporate Administration	Other Funds
	Trading and Settlements	

Activity Based Costs were already divided between Discretionary and Non-Discretionary therefore only per advisor costs were needed. The method used to calculate Direct advisor cost, Indirect advisor costs, and Fixed costs was to first separate costs into the appropriate categories. This was conducted in consultation with the firm's Chief Financial Officer. Once these costs were categorized, a number of full time employees was needed to determine a per advisor cost. This was available in the firm's activity based costing analysis.

As the firm's activity based costs were still under revision, some adjustments were made to allocate the appropriate proportion of costs to the Discretionary and Non-Discretionary advisors, which were not accomplished in the Activity Based Costing analysis.

Table 2.8.2 Costs of Opening a New Branch Office

Office Set-up Costs
Rent and operating
Alarm/Internet
Hiring and Business Planning
Premise Insurance
Receptionist

The Office Set-up costs include furniture, signage, and other one-time expenses. Other on-goings costs were estimated such as rent, and ongoing premise insurance.

2.9. Profitability Model and Scenario Analysis Tool

A profitability model was constructed in MS Excel and incorporated the cost model as well as the calculation of revenue growth. Once Book Value growth was created, a percentage of Book Value at each month estimated expected revenue streams. The profitability model was based on quarterly profit figures, as this is the norm for analyzing financial data. The model was built to incorporate many parameters such as inflation rate for costs and market growth rate for estimating the amount of Assets Under Management for each advisor.

The firm had conducted previous market analysis on the cities in which they were considering expanding to and, thus, knew the size of each potential market in terms of Assets Under Management. Therefore, our model incorporated a parameter for adjusting the size of each new market as well as a parameter for changing the percentage of market share the firm was aiming to capture in a 10-year horizon.

In addition to the parameters included in the model, additional controls were added to define whether a new office would be placed in a new market. This would affect costs for servicing the new market, as there would be additional office set up costs. Other controls were added to define whether a new advisor would be hired and when in the 10-year horizon this would occur. Currently the model can include hiring 3 Discretionary and 3 Non-Discretionary advisors, although, this could easily be scaled to include more advisors.

Once all parameters are entered into the model, graphs as well as scenario statistics are generated to allow the user to understand the profitability margin of the growth plan. The model outputs the following statistics when a scenario is entered: Net Present Value, Internal Rate of Return, total Assets Under Management after 5-years, Total Assets Under Management after 10-years, Time when the investment will breakeven, and Maximum Quarterly Cash outlay during the 10 year investment. The graphs that are created for each scenario are 10-year Revenue growth curves, 10-year expected costs, and 10-year net profit streams.

The main decision is to determine the most profitable 10-year plan based on 3 decisions:

1. Whether to open an office in the new market or whether to service the new market through advisors from their existing office?
2. How many Non-Discretionary advisors to hire and when to hire them?
3. How many Discretionary advisors to hire and when to hire them?

A VBA script was written to automate the manual process of considering every combination of the above 3 decision. The script will look at every scenario possible, by changing the parameters associated with the above 3 decision and store the scenario statistics in a large file. Once the statistics of every scenario has been gathered. The user will have the opportunity to choose the growth plan, which maximizes one of 4 criteria: Internal Rate of Return, Net Present Value, Total Assets Under Management after 10 years, and Index of Investment[2].

[2] Index of investment is defined as the ratio of the net present value of an investment and the maximum investment.

In addition, the model also outputs sensitivity analysis for the "optimal" expansion plan. This report explains the impact of specific changes to assumptions or variables on the profitability of the optimal expansion plan. We looked at the following factor changes in our sensitivity analysis: the addition or subtraction of a Discretionary advisor, the addition of a Non-Discretionary Advisor, changes in market growth rate, changes in delaying hiring an advisor, and changes to whether to service the new market locally, from a new office or remotely, from an existing office.

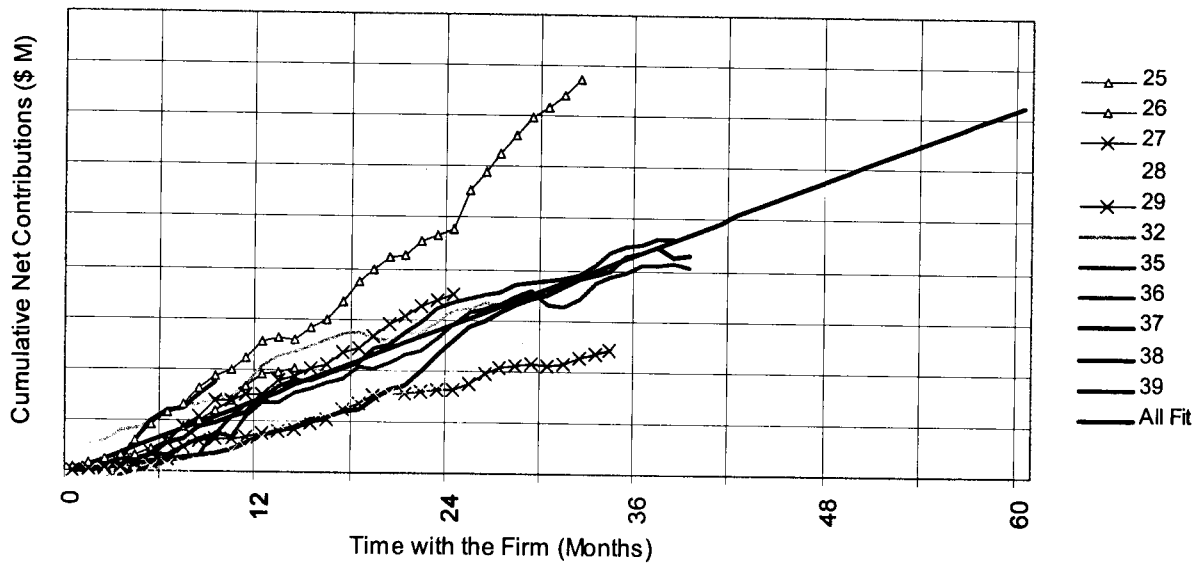
3. RESULTS

3.1. Cumulative Net Contribution Growth Models

Figure 3.1.1 and Figure 3.1.2 show every Non-Discretionary and Discretionary advisor's Cumulative Net Contributions for each month from the time they began advising with the firm. Calgary advisors are marked with a triangle, Toronto advisors are marked with a cross, and Vancouver advisors are marked with a solid line.

Non-Discretionary

Figure 3.1.1 Non-Discretionary Linear Fit of Cumulative Net Contribution For ALL Advisors



From the above graph we see that there is a Calgary advisor who is clearly outperforming the other advisors. As the firm did not view this advisor different in anyway from the other advisors the advisor was kept in the model. The final linear regression model is shown in (3.1.1). It is expected that an advisor will accumulate approximately $399,981/month in Net Contributions.

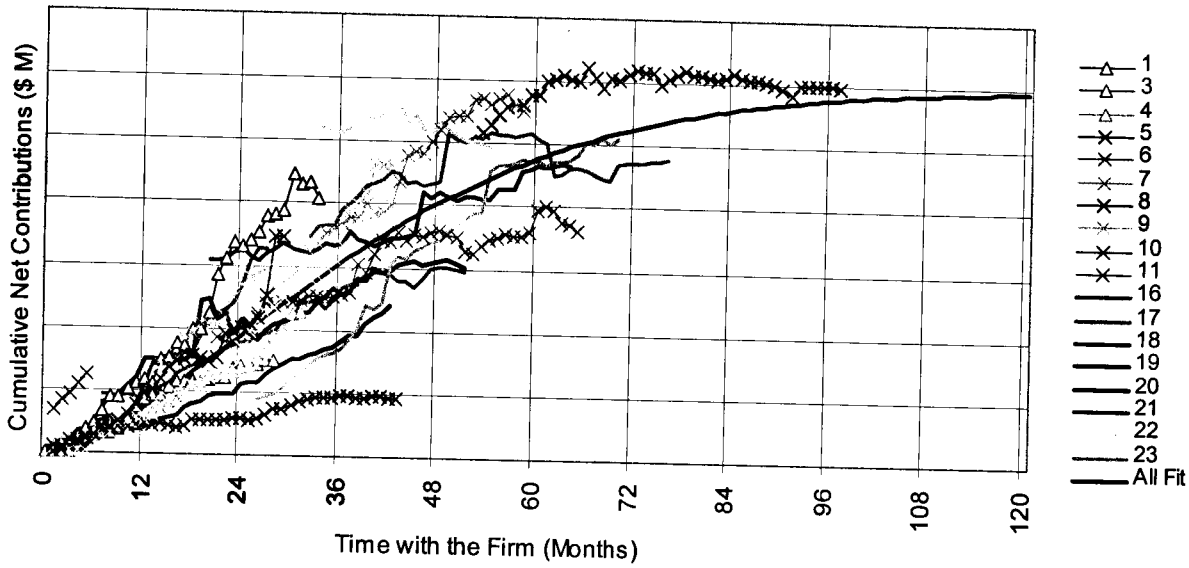
$$\hat{Y} = 399{,}981 TimeWithFirm \qquad (3.1.1)$$

As the advisors growth rates are quite variable, the fitted line does not capture the large variance in Book Value as the amount of time the advisor is with the firm increases. From the graph, the Book Value of advisors who have been working for the firm for 2 years range from a high of $37 Million to a low of $10 Million. The range in Book Value at 2 ½ years ranges from a high of $53 Million to a low of $14 Million. The standard error of the predicted value at 2 years is approximately $2.1 Million. We would like to address if similarities are present among advisors with similar growth rates. In the next section we will test the effects of Location, Advisor's Marketing ability, and Advisor's Skill level.

Discretionary Advisors

As noted in Section 2.1, the Weibull fit for modelling Discretionary advisors growth is restricted to $183,000,000 as there is insufficient data to constrain the model from exceeding regular business practices of $229,019,748 in Assets Under Management.

Figure 3.1.2 Discretionary Non-Linear Fit of Cumulative Net Contribution For ALL Advisors



The final 4-parameter Weibull model, using data from all advisor locations is shown in (3.1.2).

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-5.899303)x^{1.553743} \tag{3.1.2}$$

From the graph we can see a lot of variability around the fitted line. The Book Value of advisors working with the firm for 2 years, range from $16 Million to $106 Million. The Weibull curve estimates a book of 2 years to be valued at $61 Million. As with the Non-Discretionary advisors, we will test for other factors, which could be contributing to the variation around book growth. After 5 years of building their book, a Discretionary advisor is estimated to acquire approximately $145 Million of client Net Contributions.

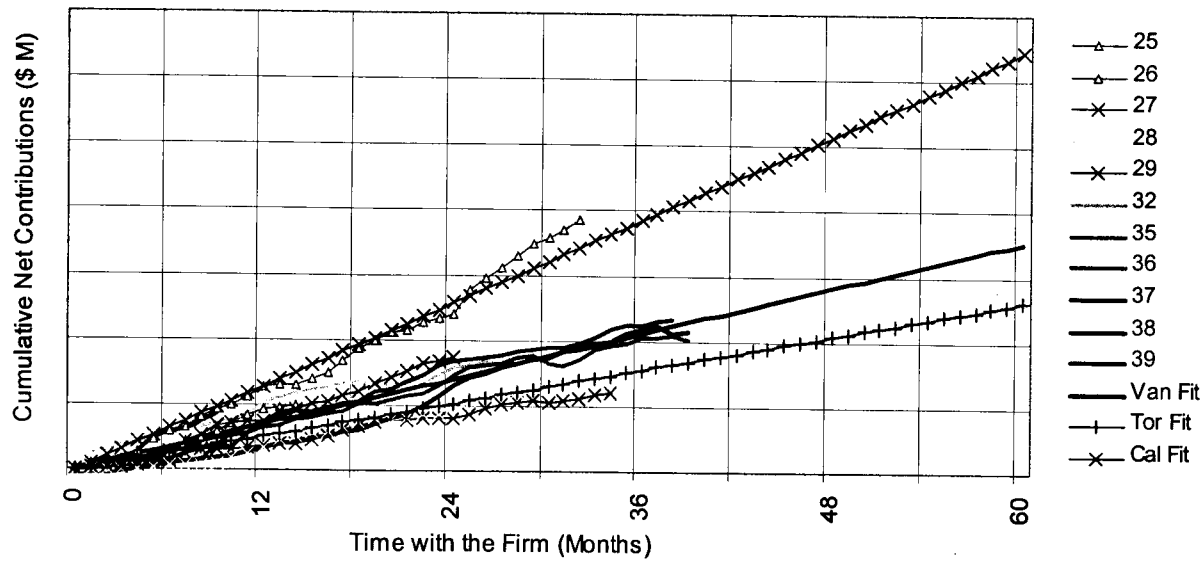
3.2. Location Effect on Growth of Cumulative Net Contributions

Figure 3.2.1 and Figure 3.2.2 show each Non-Discretionary and Discretionary Advisor's Cumulative Net Contribution growth against the amount of time the advisor has been with the firm. Calgary advisors are marked with a triangle, Toronto advisors are marked with a cross, and Vancouver advisors are marked with a solid line.

Non-Discretionary Advisors

Linear fitted lines for each advisor location are also shown for Vancouver, Toronto, and Calgary in addition to each advisors actual book growth.

Figure 3.2.1 Non-Discretionary Cumulative Net Contribution Linear Fits by Location



Notice from the above graph that there are only two Calgary advisors to model. The fit of the Calgary advisors show that at the end of a 3-year period, they will accumulate approximately $17 Million. We can see that the fitted line is fitting advisor 25, as advisor 26 has very few data points, which may be misleading if advisor 25 is an exceptionally skilled advisor. We can also see that Vancouver and Toronto's fitted growth curve are somewhat similar, with Vancouver advisors expected to accumulate approximately $14 Million, and Toronto advisors expected to accumulate approximately $9 Million after a period of 3 years.

Table 3.2.1 shows the results from the linear regression model. Parameter estimates and P-values state the significance of each variable in the model.

Table 3.2.1 Linear Regression Results

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
X	1	400,000	8,145	72.17	<.0001
a_1 * x (Toronto)	1	-128,080	15,310	-10.11	**<.0001 ***
a_2 * x (Calgary)	1	86,600	20,797	23.23	**<.0001 ***

From the regression results, both Toronto and Calgary advisors book growth are shown to be statistically different to the growth of Vancouver advisors as the calculated P-value is less than 0.05. Vancouver advisors Net Contribution growth rate is estimated at $400,000/month. Toronto advisors are expected to accumulate $128,080 /month less than a Vancouver advisor, at $271,920/month. On the other hand, Calgary advisors are expected to accumulate $86,600/

month more than a Vancouver advisor at $486,600 /month. As the estimates for both Calgary and Toronto advisors were based on very few advisors, we decided to use the fitted Cumulative Net Contribution growth for all the advisors in our profitability model. Thus Toronto advisors, in general, accumulate 32.02% less than Vancouver advisors. Calgary advisors, however, accumulate 21.65% more Net Contributions than Vancouver advisors, on average.

Table 3.2.2 shows the results from the hypothesis test that Toronto advisors growth and Calgary advisors growth do not differ.

Table 3.2.2 t-test For Differences in Slope Between Toronto and Calgary Advisors

Source	DF	Mean Square Error	F Value	Pr > F
β_1	1	3.47E+15	761.85	<.0001 *
β_2	300	4.56E+12		

As expected from the results of table 3.2.1, there does appear to be a significant difference in growth rate between Toronto advisors and Calgary advisors. The final linear models for advisor location are shown in (3.2.1). Models for each advisor location are shown in (3.2.2), (3.2.3), and (3.2.4) for Vancouver, Toronto, and Calgary advisors, respectively.

$$\hat{Y} = 400{,}000x - 128{,}080\,(a_1 * x) + 86{,}600\,(a_2 * x) \tag{3.2.1}$$

$$\hat{Y} = 400{,}000x \tag{3.2.2}$$

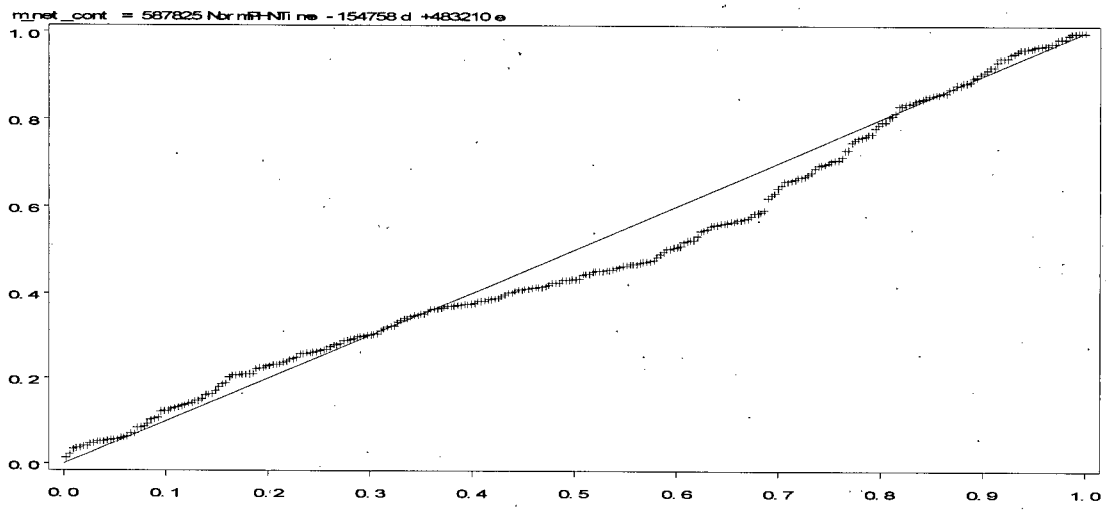
$$\hat{Y} = 271{,}920\,x \tag{3.2.3}$$

$$\hat{Y} = 486{,}600x \tag{3.2.4}$$

Although, our tests show that Calgary advisors tend to grow their books at a faster rate, we must also consider that there are only two advisors data available to model Calgary advisors. This is generally not a large enough sample to perform such statistical tests.

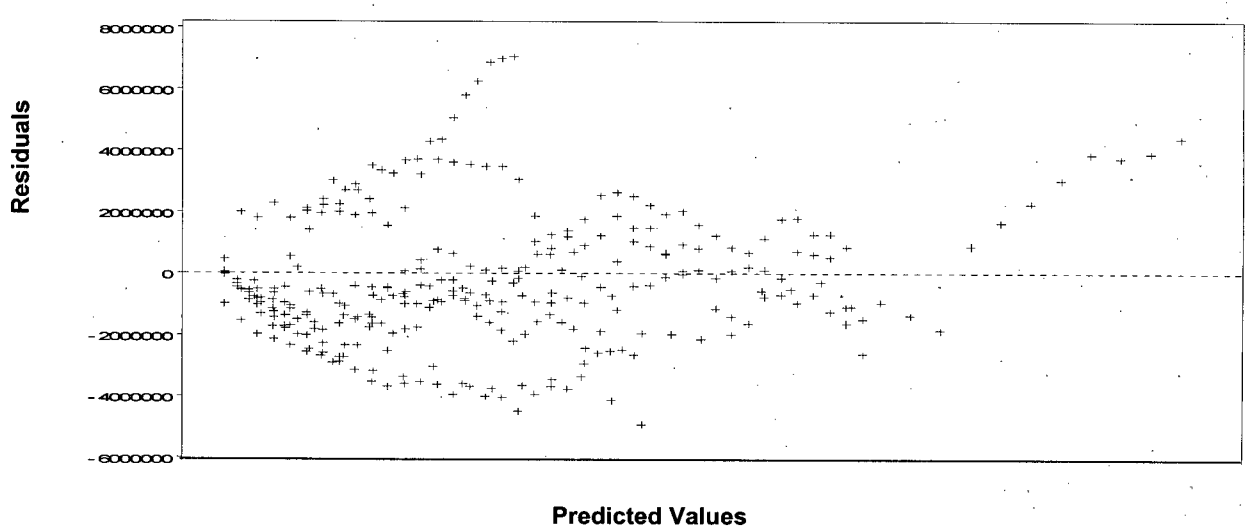
We conducted residual analysis on model (3.2.1) to assure that assumptions of normality and independence were not violated. Figure 3.2.2 shows the normal probability plot of the residuals. Figure 3.2.3 shows the residuals plotted against the predicted values.

Figure 3.2.2 Normal Cumulative Distribution vs. Residuals Cumulative Distribution



From this normal probability plot, we see that the residuals are not quite following the normal distribution. The residuals at the tails of the distribution tends to be following that of the normal curve, however, the residuals towards the centre tend to deviate from normal distribution. The differences, however, do not seem to suggest that the residuals are seriously violating the normal distribution.

Figure 3.2.3 Reisduals vs. Predicted Values



In this plot, we see non-constant variance and no trends in the residuals. In particular, the variance appears to decrease near the mid-point of the predicted values.

Discretionary Advisors

Figure 3.2.4 Discretionary Cumulative Net Contribution Non-Linear Fits by Location

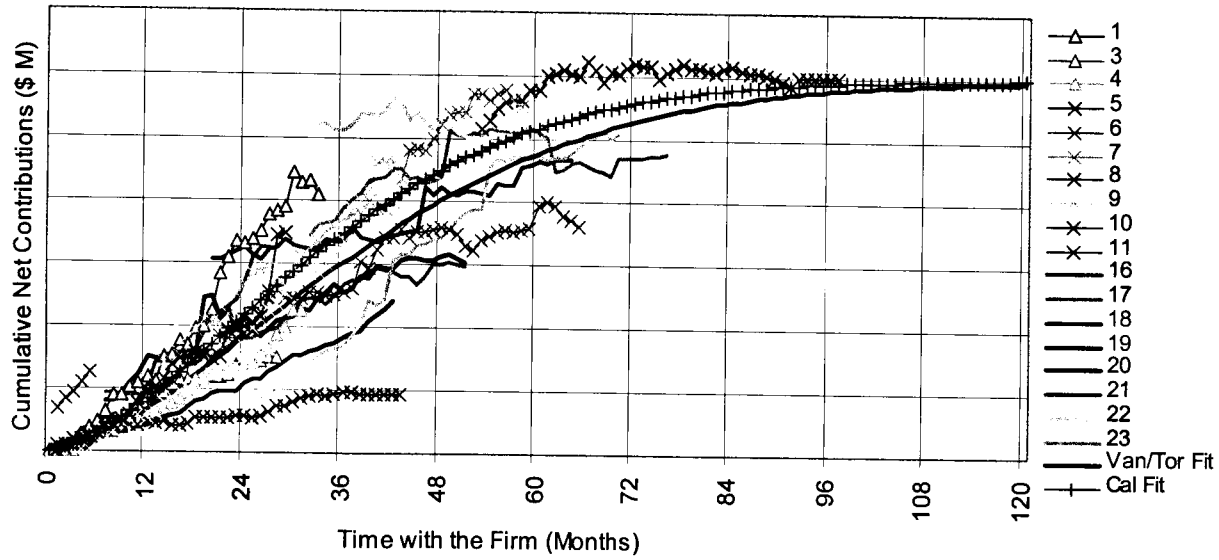


Table 3.2.3 shows the resulting parameter estimates from the Weibull curve used to model Location effect.

Table 3.2.3 Parameter Estimates

Parameter	Estimate	Standard Error	t Value	Pr > |t|
γ	6.121407	0.1966	31.14	<.0001
β_2 (Toronto)	0.019283	0.04	0.48	0.6298
β_3 (Calgary)	0.221214	0.0758	2.92	0.0036 *
δ	1.608188	0.0528	30.46	<.0001

The above P-values show that we cannot reject the hypothesis that initial growth rate of Toronto advisors equals the initial growth rate of Vancouver advisors. However, we can reject the hypothesis that Calgary's advisors initial growth rate is equal to Vancouver's advisors initial growth rate.

Table 3.2.4 Wald's Test

Wald's Test	Statistic	Pr > χ^2
$\beta_2 = \beta_3$	6.80	0.0091 *

Wald's test statistic was used to confirm that Toronto advisors and Calgary advisors have different initial growth rates. With a P-value less than 0.05, we can reject the hypothesis that Toronto and Calgary growth rates are equal. As we could not reject the hypothesis that Toronto

advisors' book growth rate was equal to Vancouver advisors' book growth rate, their modelled Weibull Curves remain the same. As Calgary advisors' initial growth rate was found to be greater than that of Vancouver advisors, we expect to see a steeper increase in growth. The final model for Discretionary advisors Book Value growth by location is shown in (3.2.5). Vancouver/ Toronto and Calgary's fitted linear models are shown in (3.2.6) and (3.2.7).

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 \exp(-6.1214 + 0.2212\ a_2)\ x^{1.6082} \tag{3.2.5}$$

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-6.1214) x^{1.6082} \tag{3.2.6}$$

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-6.3426) x^{1.6082} \tag{3.2.7}$$

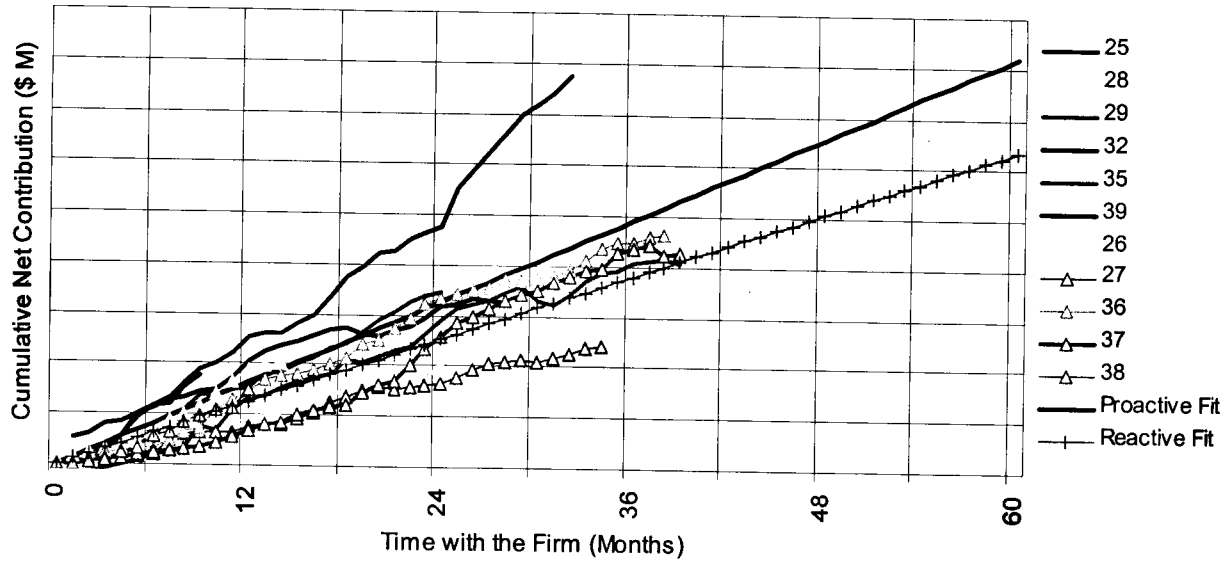
Thus, our results showed that after 5 years of building their book, Vancouver and Toronto advisors are estimated to accumulate $145,623,047 Million. Furthermore, a Calgary advisor, with an equivalent 5-year period are estimated to accumulated a Book Valued at $157,815,767 Million. This translated to approximately 10 to 15 more clients per advisor.

3.3. Marketing Effect on Growth of Cumulative Net Contributions

Figures 3.3.1 and Figure 3.3.2 show the Non-Discretionary and Discretionary advisors Cumulative Net Contributions for each month they have been working with the firm. They are segmented by marketing ability. Advisors rated proactive are marked with a solid line and advisors rated Reactive are marked with a triangle.

Non-Discretionary Advisors

Figure 3.3.1 Non-Discretionary Advisors Grouped by Marketing Ability



From the Figure 3.3.1, we can see that the rate of book growth of Proactive advisors is greater than the rate of growth for Reactive advisors. A Proactive advisor is expected to accumulate approximately $42 Million after 5 years of building their book, whereas a Reactive advisor is expected to accumulate close to $32 Million over the same time period. Thus, a Proactive advisor shows a 31.25% increase in Cumulative Net Contributions compared to a Reactive advisor.

Table 3.3.3 Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
X	1	700,000	16,019	32.98	<.0001
$m_1 * x$	1	204,088	22,809	6.75	**<.0001 ***

From this table, we can see that Proactive advisors tend to have a faster rate of growth compared to Reactive advisors. For each month, a Proactive Non-Discretionary advisor will accumulate approximately $204,088 more than an equivalent Reactive advisor. The final linear model is shown in equation (3.3.1). The resulting Cumulative Net Contribution model for proactive and Reactive Non-Discretionary marketers is shown in (3.3.2), and (3.3.3).

$$\hat{Y} = 700{,}000x + 204{,}088\ (m_1 * x) \tag{3.3.1}$$

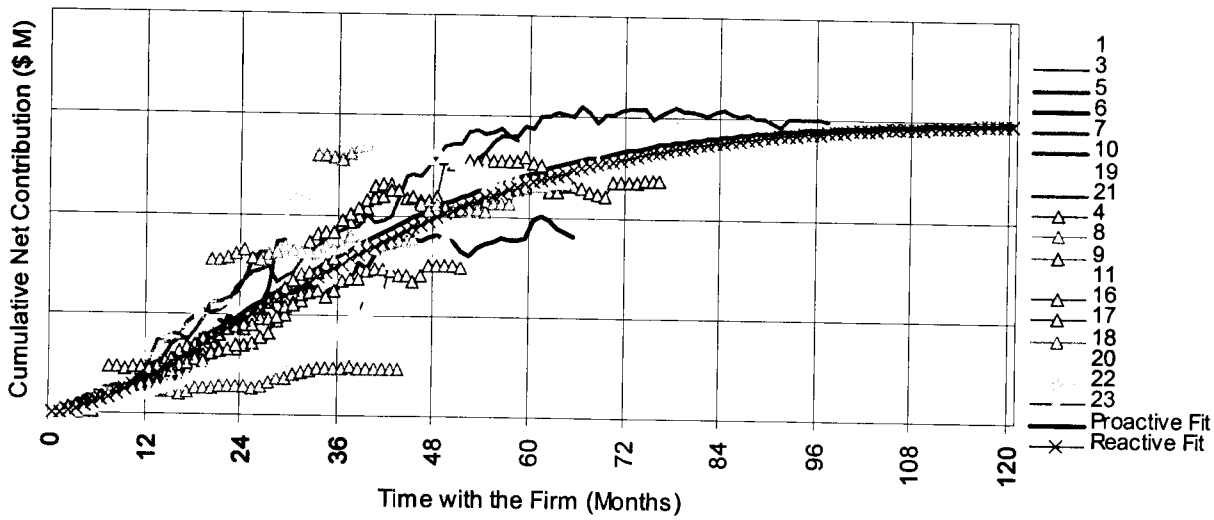
$$\hat{Y} = 700{,}000x + 204{,}088 * x \tag{3.3.2}$$

$$\hat{Y} = 700{,}000x \tag{3.3.3}$$

Over a 5-year period, a proactive Non-Discretionary advisor will expect to accumulate $12.2 Million more than a Reactive advisor. This result was very interesting to management as they sought for solid evidence that their subjective assessment of Proactive advisors were correct. They will in the future target advisors with the skills to proactively market for new clients.

Discretionary Advisors

Figure 3.3.2 Discretionary Advisors Grouped by Marketing Ability



The above graphs show the Weibull fitted curves for Proactive and Reactive Discretionary advisors. Proactive advisors tend to show an increased rate of growth compared to Non-Discretionary advisors. Table 3.3.4 show the results of our test for differences in initial growth rate between Proactive advisors and Reactive advisors. After 3 years of building their book, a proactive advisor will accumulate $98,012,236 Million compared to a Reactive advisor with $91,999,964 Million. This difference corresponds to approximately 4 additional clients for Proactive advisors.

Table 3.3.4 Parameter Estimates

Parameter	Estimate	Standard Error	t Value	Pr > |t|
γ	5.837433	0.2138	27.3	<.0001
δ	0.092945	0.0465	2	0.046
β_1 (proactive)	1.529785	0.0573	26.7	**<.0001 ***

Wald's test of Proactive effect on Cumulative Net Contribution growth shows that we can reject the hypothesis that Proactive and Reactive advisors initial rate of growth, γ, are equal. The final model for Proactive and Reactive advisors is shown in 3.3.5. The model for Proactive advisors is shown in 3.3.6 and for Reactive advisors in 3.3.7.

$$Y = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-5.837 + 1.529\, a_1) x^{0.092} + \varepsilon \qquad (3.3.5)$$

$$Y = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-5.837 + 1.529) x^{0.092} + \varepsilon \qquad (3.3.6)$$

$$Y = 183{,}000{,}000 - 183{,}000{,}000 * \exp(-5.837)\, x^{0.092} + \varepsilon \qquad (3.3.7)$$

After a 5-year period of building a book, a proactive Discretionary advisor is expected to acquire approximately $148,896,418 compared to a Reactive advisor who is expected to acquire $143,393,607. Thus a proactive advisor is estimated to have 3.8% more in Cumulative Net Contributions in comparison to a Reactive advisor, after 5 years. This increase translates to approximately 4 more clients for Proactive advisors than Reactive advisors. The difference between Proactive and Reactive advisors is not as large as management had originally predicted. It was suggested from the firm's management that there could be a spill over effect, where Proactive advisors are passing leads to Reactive advisors, which could explain why the difference in growth of their proactive and Reactive advisors is relatively small.

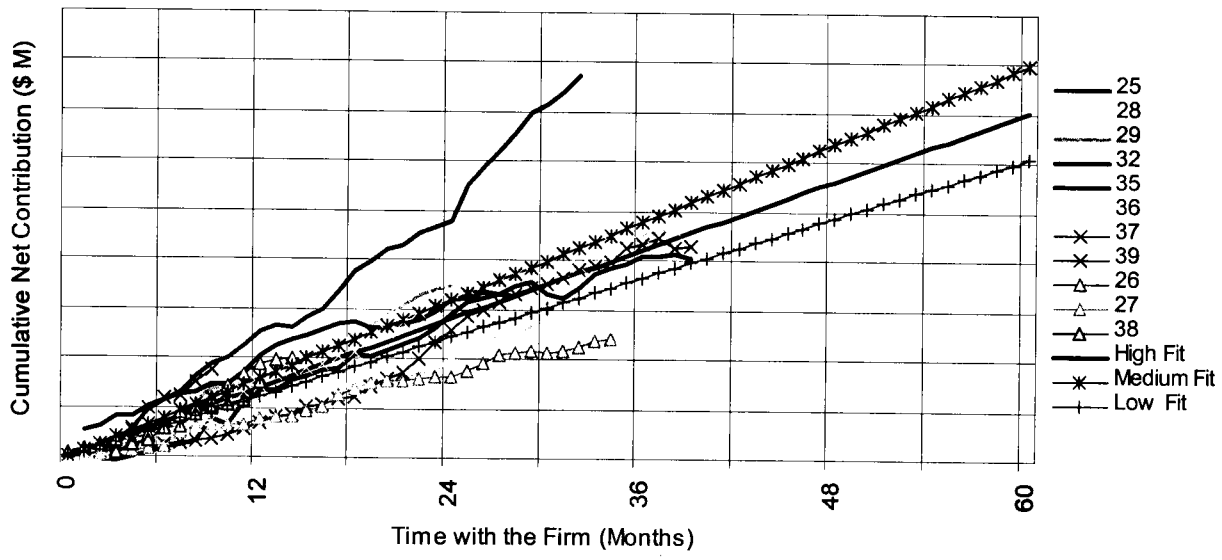
3.4. Advisor Skill Level Effect on Growth of Cumulative Net Contributions

Figures 3.4.1 and Figure 3.4.2 show the Non-Discretionary and Discretionary advisors Cumulative Net Contributions for each month they have been working with the firm. They are segmented into 3 levels for skill: High, Medium, and Low. Advisors rated High Skilled are marked with a solid line, advisors rated Medium Skilled are marked with a cross, and advisors rated Low Skilled are marked with a triangle.

Non-Discretionary Advisors

Figures 3.4.1 show the Non-Discretionary advisor's fitted linear curves for High, Medium, and Low Skilled advisors.

Figure 3.4.1 Non-Discretionary Advisors Grouped by Skill Level



From Figure 3.4.1 we see that Medium Skilled advisors outperformed High Skilled and Low Skilled advisors, which is surprising. We notice that advisor 25 outperformed all other advisors

including other High Skilled advisors. Table 3.4.3 show the results from a linear regression model.

Table 3.4.3 Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t – Value	Pr > |t|
X	1	800,000	50896	9.97	<.0001
S_1 * x (high)	1	123,088	52577	1.49	**0.1388**
S_2 * x (med.)	1	246,991	53602	2.92	**0.0038** *

From above, we can reject our hypothesis that Medium Skilled advisors have the same rate of growth as Low Skilled advisors. For each month, a Medium Skilled Non-Discretionary advisor is estimated to accumulate $123,088 more than an equivalent Low Skilled advisor. On the other hand, we cannot reject our hypothesis that High Skilled advisors, including the large growth of the outlier (advisor 25) have the same rate of growth of Cumulative Net Contributions as Low Skilled advisors. This finding was very surprising and puzzling to members of the firm.

Table 3.4.4 show the results from testing differences in growth rates among High Skilled and Medium Skilled advisors.

Table 3.4.4 Test Differences in Slope Between Highly Skilled and Medium Skilled Advisors

Source	DF	Mean Square	F Value	Pr > F
β_1	1	9.37E+13	13.53	**0.0003** *
β_2	248	6.93E+12		

As the P-value is less than 0.05, we can reject the hypothesis that Medium and High Skilled advisors have the same rate of growth. This concurs with our previous observations that Medium Skilled advisors and Low Skilled advisors show large differences in growth. However, High Skilled advisors and Low Skilled advisors do not show large differences in growth. The final linear model for all skill levels is shown in equation (3.4.1). The model for High and Medium Skilled advisors is shown in equation (3.4.2) and (3.4.3).

$$Y = 800{,}000x + 123{,}088\,(s_1 * x) + 246{,}991\,(s_2 * x) + \varepsilon \qquad (3.4.1)$$

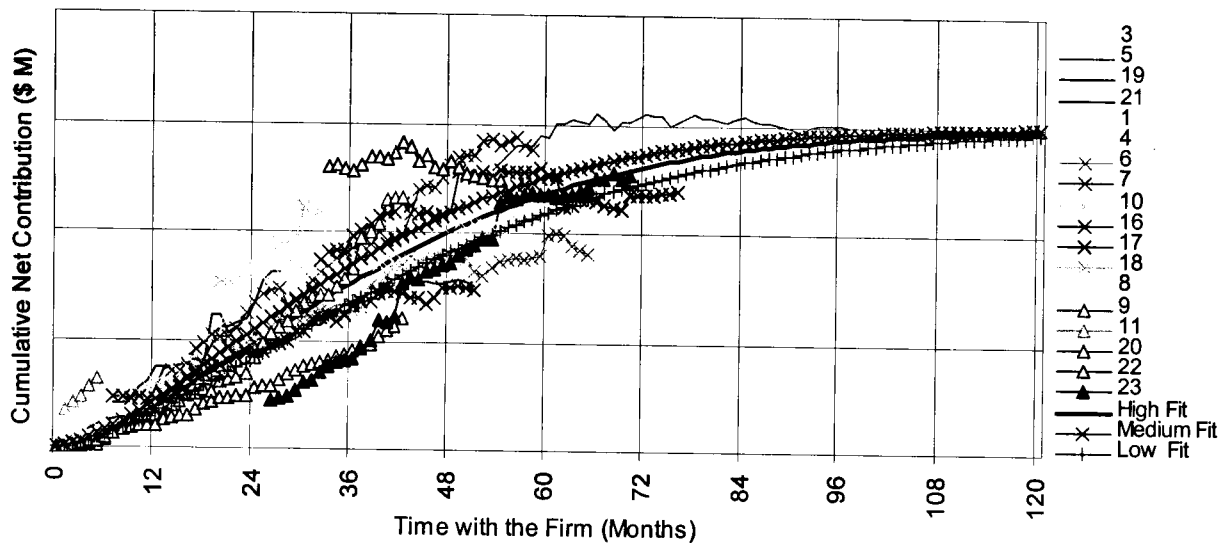
$$Y = 800{,}000\,x + \varepsilon \qquad (3.4.2)$$

$$Y = 1{,}046{,}991\,(s_2 x) + \varepsilon \qquad (3.4.3)$$

On average a High and Low Skilled advisors accumulates $ 48,000,000 in a 5-year period, compared to approximately $ 63,000,000 for Medium Skilled advisor. This did not make intuitive sense to members of the firm and thus they considered the possibility that their subjective assessments of their advisors may have been biased.

Discretionary Advisors

Figure 3.4.2 Discretionary Advisors Grouped by Skill Level



From Figure 3.4.2 we see that, as observed with the Non-Discretionary advisors, the Medium Skilled advisors are showing greater growth of Cumulative Net Contributions. From the above graph, we can see that the weibull curves for Low rated advisors show a delayed exponential growth of Net Contributions compared to the growth for High and Medium rated advisors growth, affirming assumptions made by our sponsors. Table 3.4.5 show the results from our tests on parameter γ, in the Weibull model proposed in Section 2.5.

Table 3.4.5 Skill Level Parameter Estimates For Discretionary Advisors

Parameter	Estimate	Standard Error	t - Value	Pr > |t|
γ	5.944062	0.1705	34.85	<.0001
δ	0.332218	0.042	7.91	<.0001
β_1 (High)	0.174601	0.0484	3.61	**0.0003 ***
β_2 (Medium)	1.518386	0.0467	32.53	**<.0001 ***

As the resulting P-value is less than 0.05, we can reject our hypothesis that High Skilled Discretionary advisors book growth rate is equal to the book growth rate of Low Skilled advisors. The same can be concluded for Medium Skilled advisors, as we can reject our hypothesis that Medium Skilled advisors book growth rate is equal to the book growth rate of Low Skilled Discretionary advisors. These results affirm assumptions made by the firm's management.

Table 3.4.6 Walds Test For differences between Highly Skill and Medium Skilled Advisors

Test	Statistic	Pr > Chi Squared	Label
$\beta_1 = \beta_2$	11.82	0.0006	High Effect=Medium Effect

As the resulting P-value is less than 0.05, we can reject our hypothesis that Medium and High Skilled advisors have the same initial book growth rate. Moreover, Medium Skilled advisors are estimated to have a larger initial growth rate than High Skilled advisors, which conflicts with assumptions made by from the firm. The final model is shown in 3.4.4. Models for High, Medium, and Low Skilled Discretionary advisors are shown in 3.4.5, 3.4.6, and 3.4.7 respectively.

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 \exp(-5.944 + 0.1746\, s_1 + 1.5184\, s_2)\, x^{0.3322} \qquad (3.4.4)$$

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 \exp(-5.944 + 0.1746)\; x^{0.3322} \qquad (3.4.5)$$

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 \exp(-5.944 + 1.5184)\; x^{0.3322} \qquad (3.4.6)$$

$$\hat{Y} = 183{,}000{,}000 - 183{,}000{,}000 \exp(-5.944)\; x^{0.3322} \qquad (3.4.7)$$

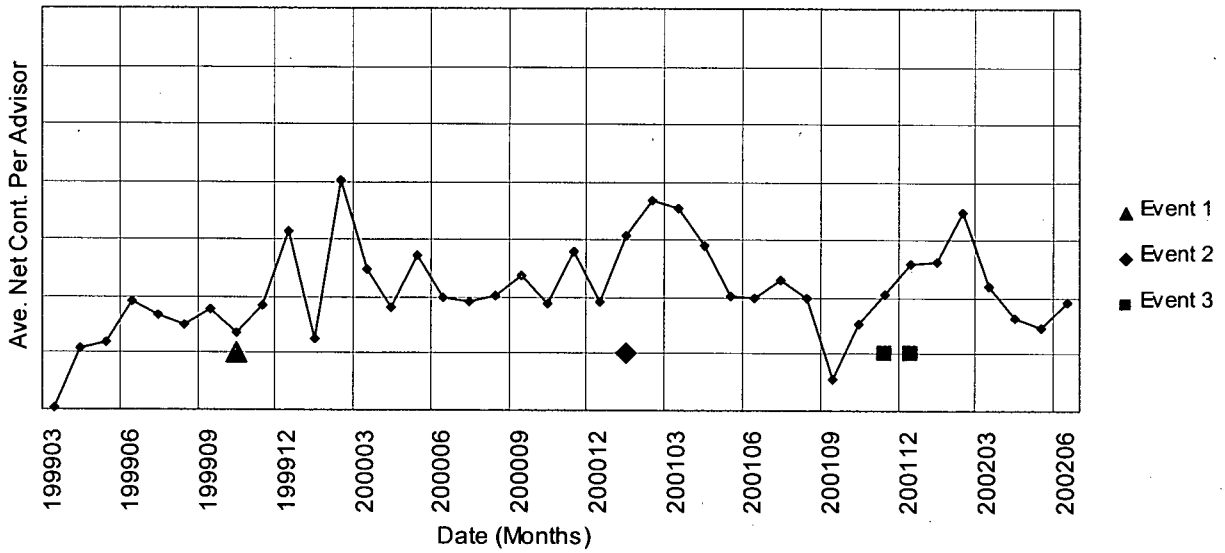
After 5 years of growing a book, a High Skilled Discretionary advisor will accumulate approximately $144,681,525 compared to a Medium Skilled advisor who will accumulate approximately $153,687,290 and a Low Skilled advisor with $133,737,661. Thus, a High Skilled advisor will have approximately 8.2% more client Net Contributions than a Low Skilled advisor. A Medium Skilled advisor, however, will acquire approximately 14.8% more than a Low Skilled advisor.

3.5. Financial Press Coverage Effect on Average Net Contributions

The timing of positive financial coverage in magazines and newspaper publications were analyzed on Average Net Contributions for a Vancouver, Toronto, and Calgary advisor to determine whether there were significant increases or decreases 6 months after a positive event compared to one and a half years. As noted in Section 2.6, if data is not available to create a one and a half year sample before the event, the data points, which were available, represented the amount of Net Contributions before the publication. We analyzed Non-Discretionary advisors, Discretionary advisors, and Unassigned Clients separately to understand how these events affect different business areas of the private client sector. Figures 3.5.1 to 3.5.3 show Average Net Contributions for Non-Discretionary advisors. Figures 3.5.4 to 3.5.7 show Average Net Contributions for Discretionary advisors. Figures 3.5.8 to 3.5.11 show total Net Contributions for all Vancouver, Toronto, Calgary, and Other Clients as described in Section 2.6.

Non-Discretionary

Figure 3.5.1 Average Net Contributions For a Vancouver Non-Discretionary Advisor



From Figure 3.5.1 we see that Vancouver advisor acquires larger Average Net Contributions after the positive publication compared to the months prior. Table 3.5.1 summarizes the results of the significance of each event on Vancouver Discretionary advisors.

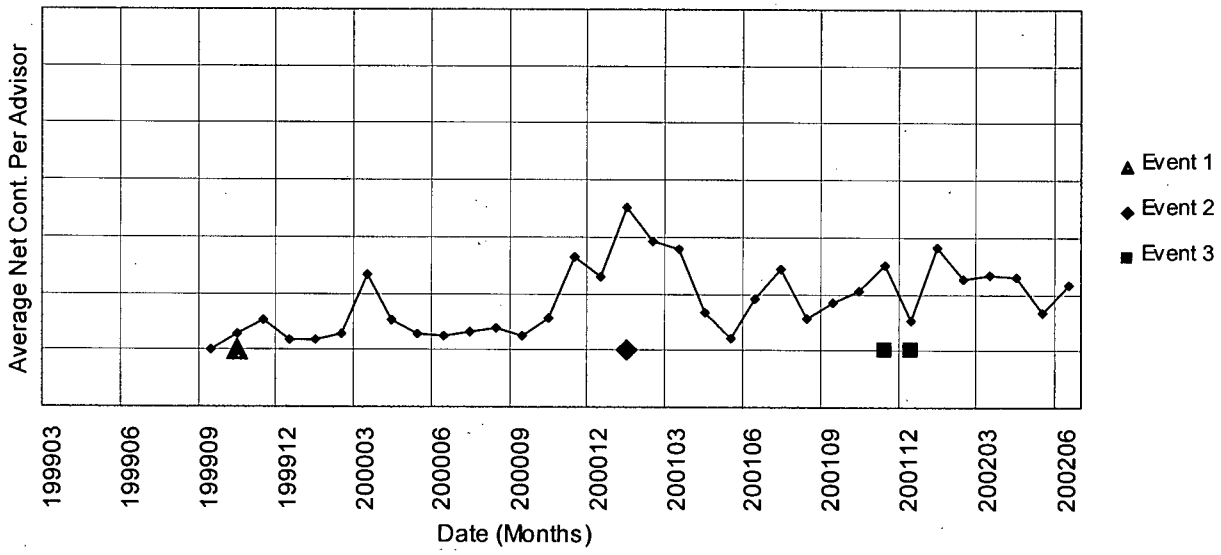
Table 3.5.1 T-tests with Equal Variance For Vancouver Non-Discretionary Advisors

Event	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t – Value	Pr > ltl
Before Event 1	206,429	295,188	12	-2.59	**0.0235 ***
After Event 1	1,061,335	509,883			
Before Event 2	835,355	345,089	22	-2.21	**0.0382 ***
After Event 2	1,393,577	370,105			
Before Event 3	946,903	374,018	23	-0.02	**0.9808**
After Event 3	952,963	341,054			

The above tests, allow us to draw several conclusions in regard to the effect of Event 1, Event 2, and Event 3 on the Average Net Contributions per advisor. As the P-values of the first hypotheses tests is less than 0.05, we can reject the hypothesis that the Average Net Contributions prior to Event 1 and following Event 1 are equal. Similar conclusions can be made of Event 2 as the resulting P-value is less than 0.05. We can reject the hypothesis that the Average Net Contributions before and after Event 2 are equal. However, a similar conclusion cannot be made for Event 3 as the resulting P-value is greater than 0.05. Thus we cannot reject the hypothesis that the Average Net Contributions before and after Event 3 are equal

Our results show that the Average Net Contribution per advisor was $159,596 per month before and $718,249 per month after Event 1, a 350% increase. Similar growth is found after Event 2, where advisor's Average Net Contributions grew from $570,578 per month before the event to $935,358 per month after the event, a 64% increase. In contrast, Average Net Contributions do not appear to change after the occurrence of Event 3, where advisor's Average Net Contribution increases from $643,471 to $647,431 per month, which represents a mere 0.6% increase.

Figure 3.5.2 Average Net Contributions For a Toronto Non-Discretionary Advisor



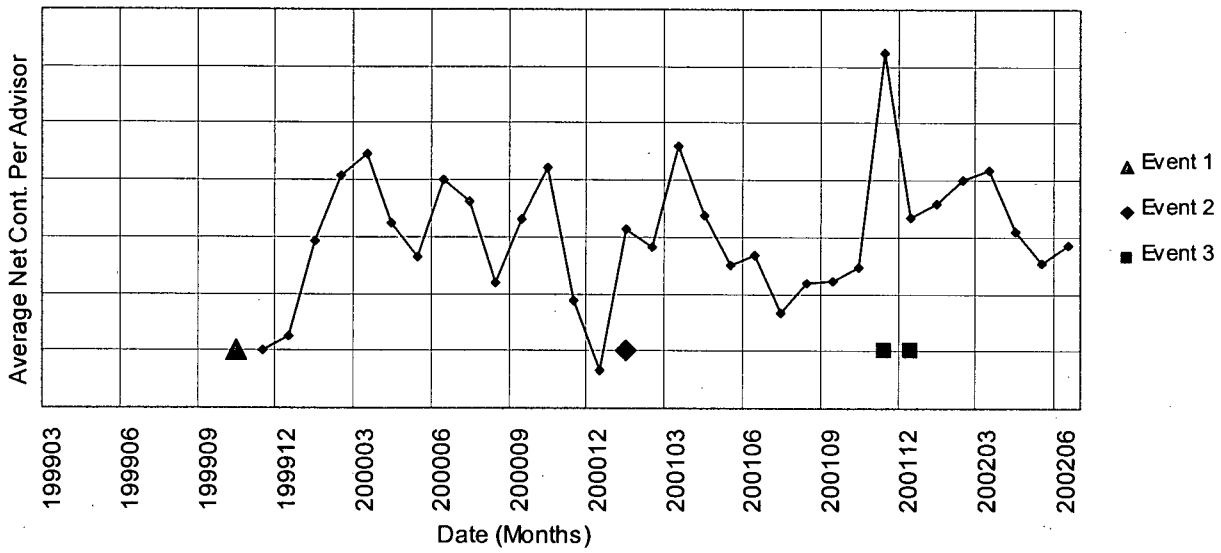
As Toronto Non-Discretionary advisors were hired one month before Event 1, we cannot compare the Net Contributions 6 months after the event to Net Contributions prior to the event. The Average Net Contributions after Event 2, and 3 are slightly larger than the contributions prior to the events. Table 3.5.2 show the results on the effect of each Event on Net Contributions from clients managed by Toronto Non-Discretionary advisors.

Table 3.5.2 T-tests with Equal Variance For Toronto Non-Discretionary Advisors

Variable	Mean Net Contribution	Standard Deviation	Degree of Freedom	t - Value	Pr > ltl
Before Event 1	76,462	105,596	6	-1.1	0.3141
After Event 1	354,807	217,065			
Before Event 2	364,596	237,377	20	-2.86	0.0096 *
After Event 2	991,577	433,852			
Before Event 3	686,524	341,966	23	-0.9	0.3766
After Event 3	881,031	229,549			

The above results allow us to make the several conclusions regarding the impact of Event 1, Event 2, and Event 3 on the Average Net Contributions of Toronto Non-Discretionary advisors. The P-values from the test of Event 1 and Event 3 are both greater than 0.05. Thus we cannot reject our hypothesis that the Average Net Contributions before and after Event 1 are equal. Similarly, we cannot reject our hypothesis that the Average Net Contributions before and after Event 3 are equal. On the other hand, we obtain a P-value greater than 0.05 for our test of the effect of Event 2 on Average Net Contribution. Thus, we can reject our hypothesis that the Average Net Contributions before and after Event 2 are equal. The Average Net Contribution following Event 2 changes from $262,953 to $672,664 per month, which corresponds to a 156% increase.

Figure 3.5.3 Average Net Contributions For a Calgary Non-Discretionary Advisor



The Calgary office was opened in November 1999, therefore, no data is available prior to the Event 1. There does not seem to be any change in Net Contributions following Event 2. There does appear to be large contributions after Event 3. Table 3.5.3 shows the results from the hypotheses tests conducted for each event.

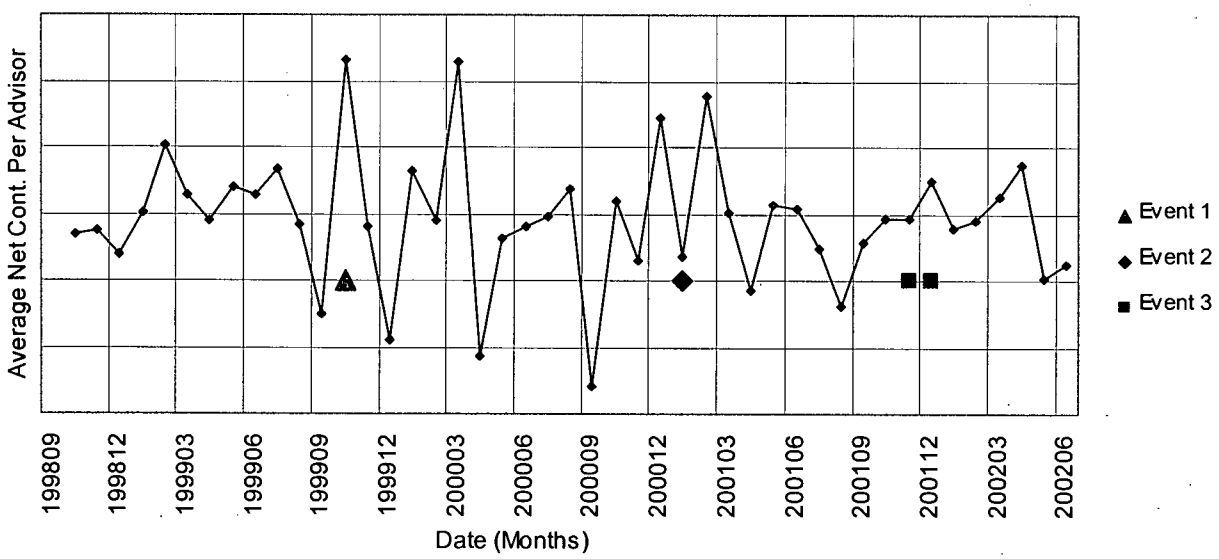
Table 3.5.3 T-tests with Equal Variance For Calgary Non-Discretionary Advisors

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 2	909,121	625,076	18	-0.65	0.5253
After Event 2	1,090,000	380,408			
Before Event 3	893,436	484,337	23	-2.33	0.029 *
After Event 3	1,430,000	592,440			

The test for the effect of Event 2 on Average Net Contribution results in a P-value that is greater than 0.05. Thus we cannot reject the hypothesis that Calgary advisors' Average Net Contribution before and after Event 2 are equal. Our test for Event 3, however results in a P-value, which is less than 0.05, thus we can reject our hypothesis that Calgary advisors' Average Net Contribution before and after Event 3 are equal. Calgary advisors show an increase in Average Net Contribution from $893,436 to $1,430,000 per month, which corresponds to a 60% increase.

Discretionary Analysis

Figure 3.5.4 Average Net Contributions For a Vancouver Discretionary Advisor



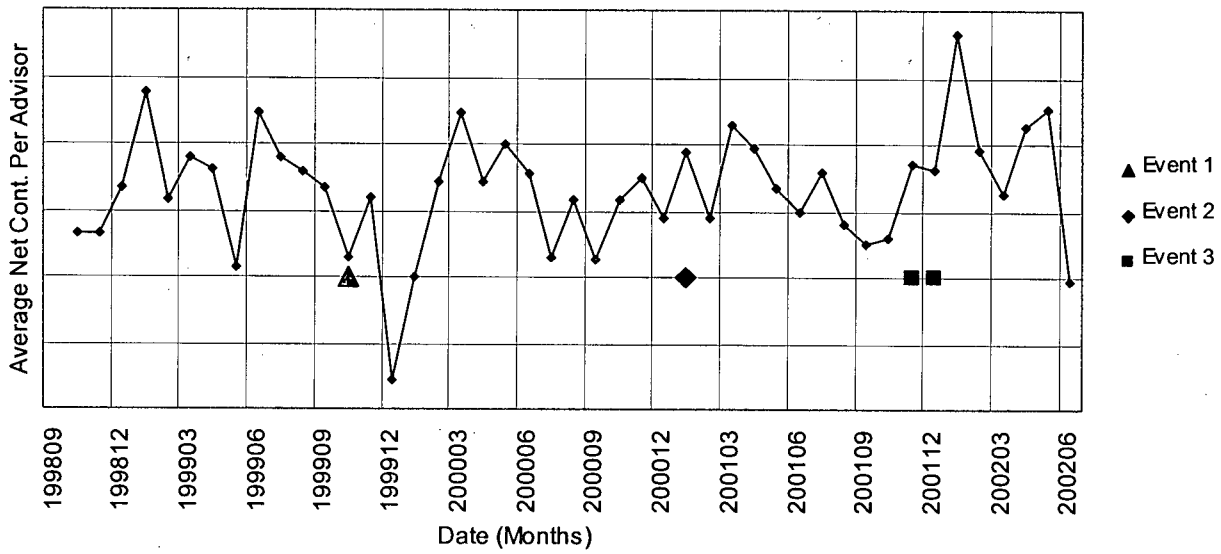
It appears that the variance of Net Contributions increase dramatically after September 1999 to May 2001, where the variance appears to be stabilizing. From this graph, we cannot observe major changes before and after the three events. Table 3.5.4 show the results from a t-test with equal variance assumption for the Vancouver Discretionary advisors.

Table 3.5.4 T-tests with Equal Variance For Vancouver Discretionary Advisors

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	1,160,000	905,384	17	0.67	0.5117
After Event 1	771,540	1,650,000			
Before Event 2	895,020	1,360,000	22	-0.22	0.8263
After Event 2	1,030,000	988,118			
Before Event 3	772,869	968,429	23	-0.62	0.5442
After Event 3	1,010,000	558,128			

From these results, we cannot reject our hypotheses that Vancouver advisors Average Net Contributions are the same, before and after each of the 3 favourable publications.

Figure 3.5.5 Average Net Contributions For a Toronto Discretionary Advisor



It appears that after Event 1 there is a sharp decrease in Net Contributions two months after the event. Both, Events 2 and 3 show increase in Average Net Contributions 6 months following the event. We test hypotheses on Average Net Contributions one and a half years before each event and 6 months after.

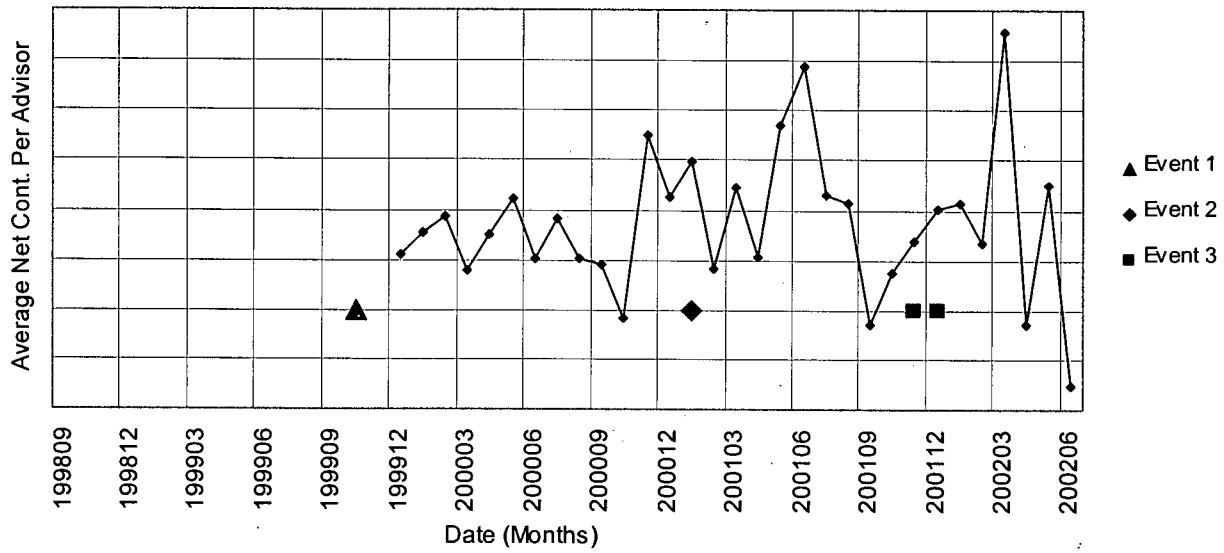
Table 3.5.5 T-tests with Equal Variance For Toronto Discretionary Advisors

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	1,350,000	782,346	17	1.05	0.3079
After Event 1	829,710	1,410,000			
Before Event 2	1,050,000	916,470	22	-1.26	0.2195
After Event 2	1,550,000	568,666			
Before Event 3	1,200,000	601,627	23	-3.19	0.004 *
After Event 3	2,140,000	790,296			

From this summary of results from our t-tests, we cannot reject our hypotheses that the Average Net Contributions before and after Event 1 are the same for Toronto advisors. Similarly, Toronto advisors do not show a significant increase in Average Net Contributions following Event 2. However, there does seem to be a significant effect of Event 3 on the Average Net Contributions for Toronto advisors. As we obtain a P-value, which is less than 0.05, we can

reject our hypothesis that the Average Net Contributions for Toronto advisors is not equal before and after Event 3. Prior to the Event 3, a Toronto Discretionary advisor acquired and average of $1,200,000 per month compared to $2,140,000 per month following Event 3.

Figure 3.5.6 Average Net Contributions For a Calgary Discretionary Advisor



There appears to be large increases in Average Net Contributions following Events 2, and 3. Table 3.5.6 shows the results from t-tests with equal variance assumptions. For each event, we tested the assumption that the Average Net Contributions one and a half years before the event was equal to the Average Net Contributions six months after the event. Table 3.5.6 summarizes our findings.

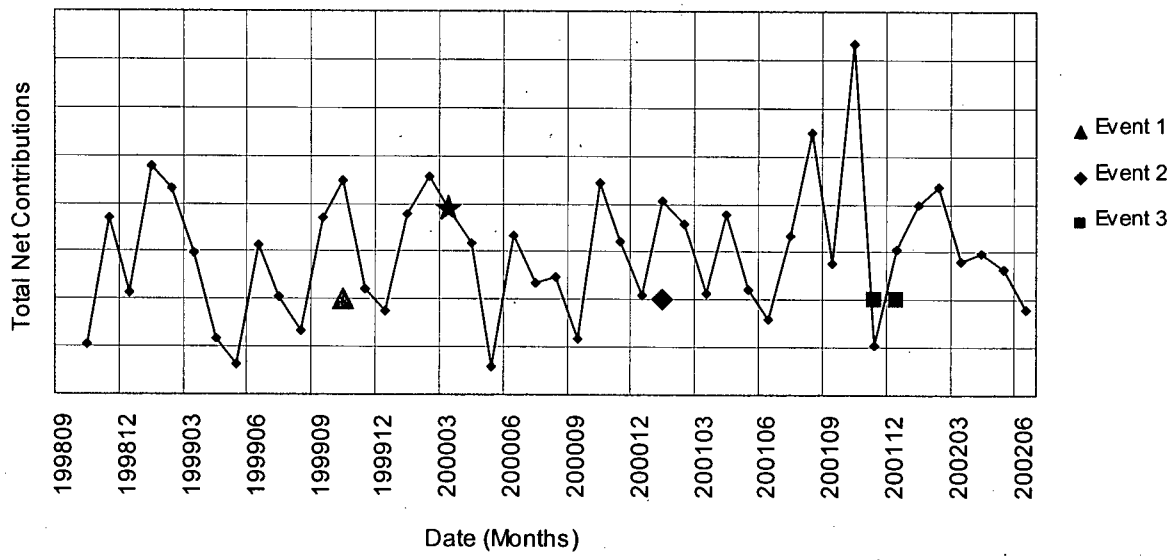
Table 3.5.6 T-tests with Unequal Variance For Calgary Discretionary Advisors

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 2	2,242,346	895,247	17	-2.08	0.0529 *
After Event 2	4,002,191	1,550,000			
Before Event 3	2,793,254	1,360,000	23	-0.38	0.7108
After Event 3	3,175,829	1,780,000			

The results show that the change in Average Net Contributions following Event 2 may be statistically significant, as the P-value is slightly higher than 0.05. However, the change in Average Net Contributions per advisor following Event 3 was not proven to be statistically significant, as the P-value is shown to be greater than 0.05.

Unassigned Clients

Figure 3.5.7 Unassigned Vancouver Clients



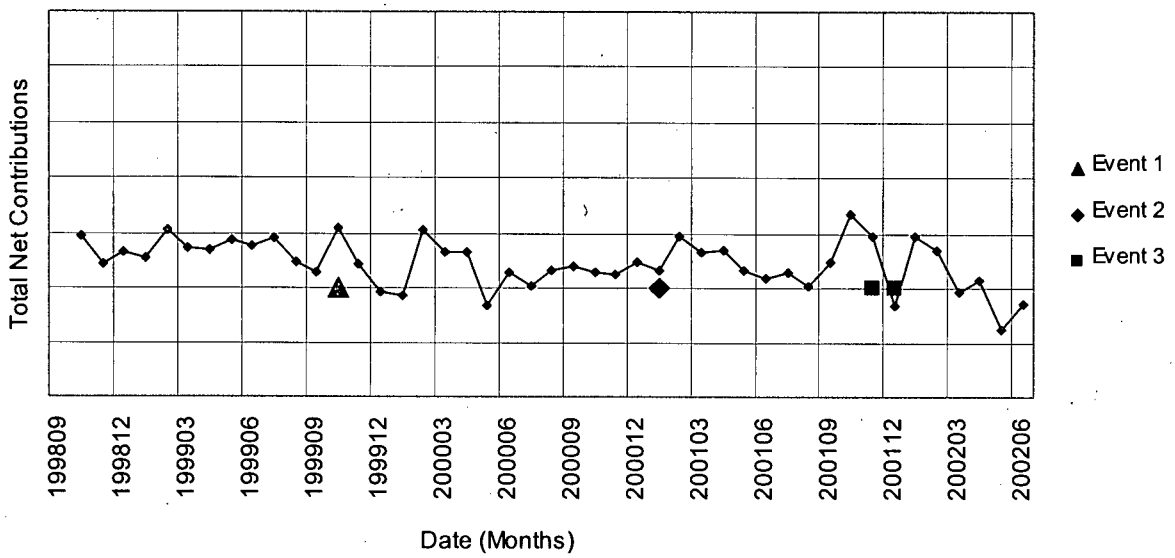
The Total Net Contributions for Vancouver clients show a sharp decrease during March 2000. Further investigation showed a series of clients withdrawing large sums at this time, which was not attributed to any particular event. We decided to remove this point and replace it with the average value of February and April 2000. The resulting data point is marked with a star. There does not appear to be large increases in Total Net Contributions of Vancouver clients 6 months after Events 1, 2, and 3.

Table 3.5.7 T-tests of Publications Effect on Vancouver Client's Net Contributions

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	1,072,204	1,430,000	5.79	0.66	0.5321
After Event 1	-431,088	3,490,000			
Before Event 2	443,755	2,190,000	22	-0.61	0.5463
After Event 2	1,322,682	1,050,000			
Before Event 3	1,645,529	1,600,000	23	0.2	0.846
After Event 3	1,452,278	1,070,000			

Our results show that none of the positive articles written about the firm and their funds had a significant impact on Net Contributions from Unassigned Vancouver clients.

Figure 3.5.8 Unassigned Toronto Clients



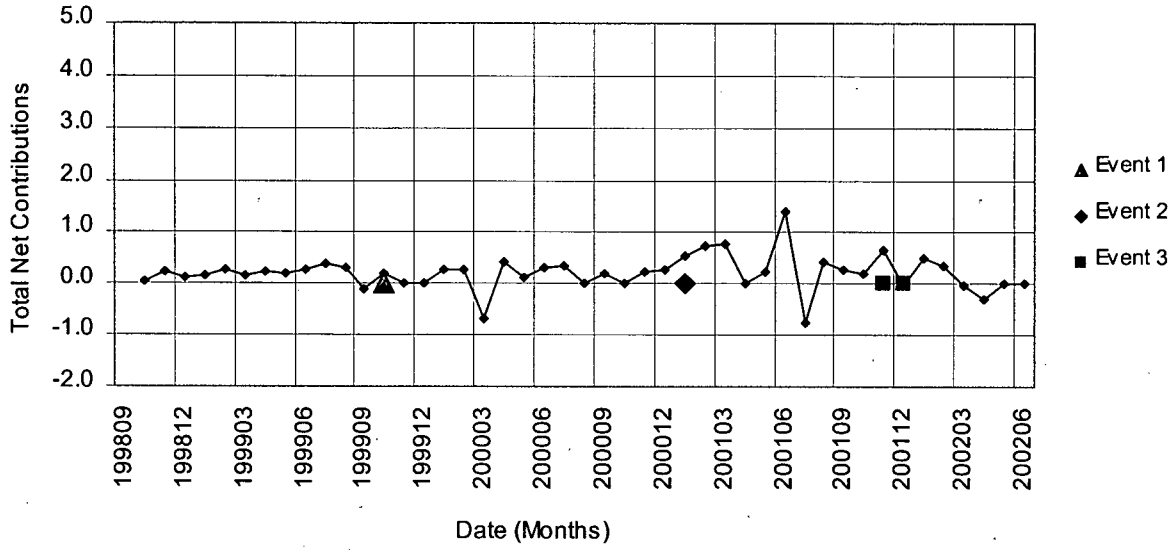
The Total Net Contributions of Toronto clients do not show any large increases following Events 1, 2, and 3. Table 3.5.8 show statistical results from our hypothesis tests.

Table 3.5.8 T-tests of Publications Effect on Toronto Client's Net Contributions

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	1,086,852	250,936	17	1.83	0.0852
After Event 1	628,147	473,516			
Before Event 2	573,014	393,729	22	-0.7	0.4913
After Event 2	761,582	294,339			
Before Event 3	563,151	367,876	23	0.82	0.4223
After Event 3	306,195	657,600			

The results from our hypotheses show that, like the Vancouver Unassigned clients no significant changes in Net Contributions after each event can be seen for Toronto Unassigned clients.

Figure 3.5.9 Unassigned Calgary Clients



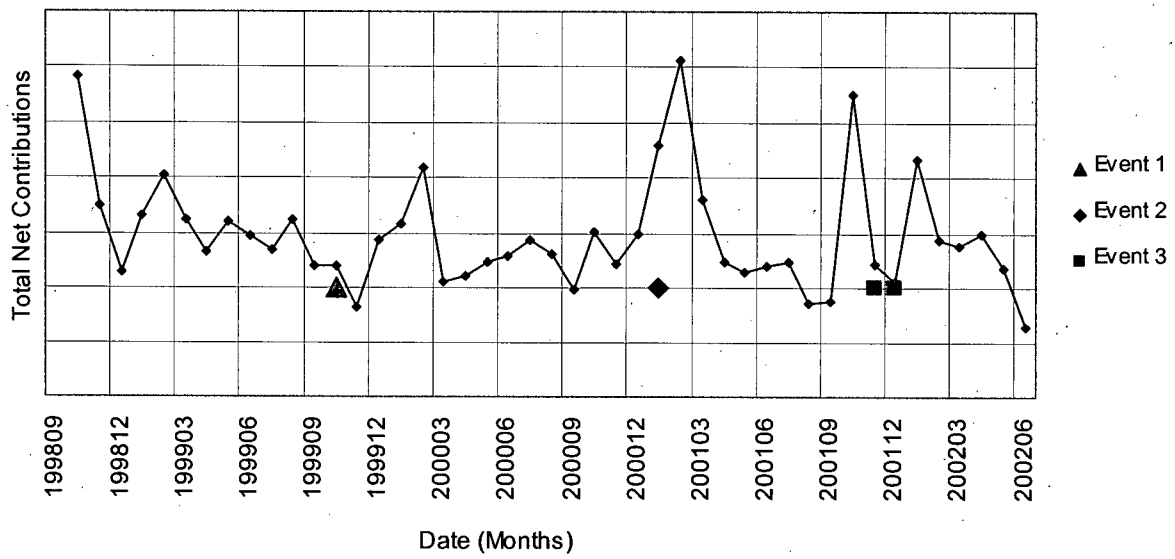
Calgary unassigned clients do not show an increase in total Net Contributions following Events 1, 3, however, there does appear to be a slight increase in total Net Contributions following Event 2.

Table 3.5.9 T-tests of Publications Effect on Calgary Client's Net Contributions

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	356,534	133,799	17	1.1	0.2848
After Event 1	40,960	406,045			
Before Event 2	265,411	265346	22	-3.03	0.0061 *
After Event 2	1,356,660	478137			
Before Event 3	620,098	428,879	23	0.69	0.4941
After Event 3	323,795	345,627			

The test for the effect of Event 2 on the Net contributions of Calgary clients yield a P-value of 0.0061, which is less than our critical value of 0.05. We, therefore, can reject our hypothesis that the Net Contributions of Calgary clients before and after Event 2 are the same. However, no effects on the Net Contributions of Calgary clients for Events 1 and 3 are found.

Figure 3.5.10 Unassigned Other Clients



The above graphs do not show any changes in slopes of Cumulative Net Contribution before and after the four events for the unassigned clients. Therefore, we cannot conclude a relationship between positive press coverage and Cumulative Net Contribution. Table 3.5.3 shows the results from tests of changes in total Net Contributions following the three events.

Table 3.5.10 T-tests of Publications Effect on Other Client's Net Contributions

Variable	Mean Net Contribution	Standard Deviation	Degrees of Freedom	t - Value	Pr > ltl
Before Event 1	1,829,165	932,819	17	1.12	0.277
After Event 1	1,038,464	909,517			
Before Event 2	979,331	569,128	22	-2.21	**0.0378**
After Event 2	2,395,376	1,540,000			
Before Event 3	1,492,499	1,230,000	23	0.32	0.7508
After Event 3	1,247,903	733,799			

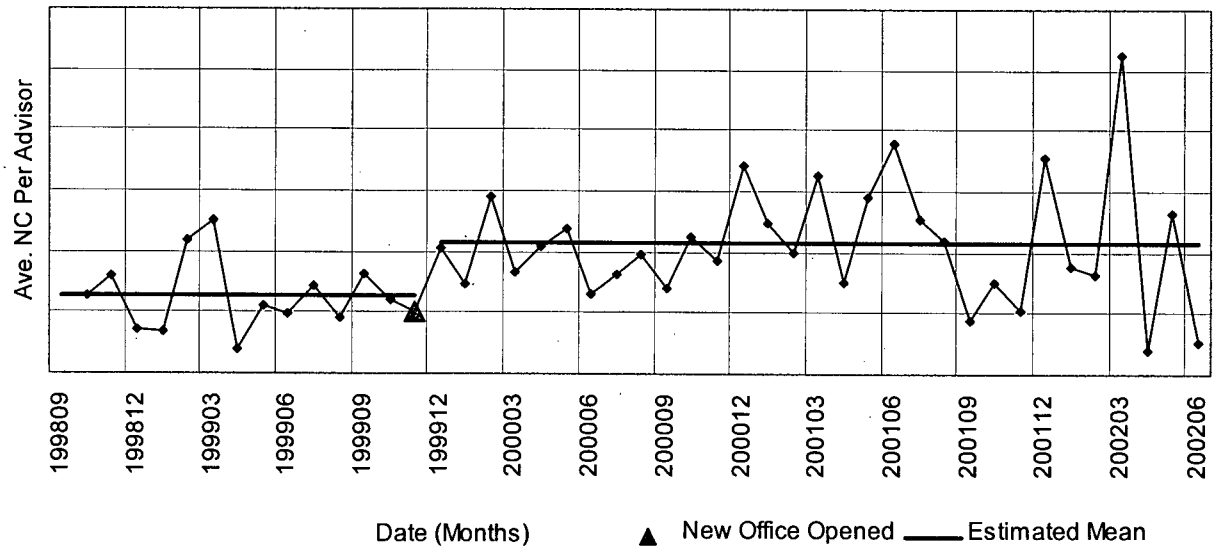
Our results showed, for all Other clients, not including Vancouver, Toronto, and Calgary customers, no increases in Net Contributions after Events 1 and 3. Following Event 2, however, we see a significant change in Net Contributions from Other clients.

3.6. Proximity Effect on Average Net Contributions

To determine whether the new Calgary office, which was opened in November 1999, had an effect on Net Contributions from Calgary clients, we analyzed average Calgary Net Contributions for Vancouver and Calgary advisors. Figure 3.6.1 shows Average Net

Contributions per advisor, for both Calgary and Vancouver advisors. Thus, all contributions from Calgary clients, prior to November 1999, are made through a Vancouver advisor. Net Contributions from Calgary clients after November 1999, are either made through a Vancouver or Calgary advisor. Table 3.6.1 shows the results from a t-test on the Average Net Contributions before and after the Calgary office.

Figure 3.6.1 Average Net Contribution Per Non-Discretionary Advisor For Calgary Clients



From Figure 3.6.1, we can visually see a large jump in Net Contributions following the opening of the Calgary office. A t-test with equal variances was performed to determine statistical significance. The results are shown in Table 3.6.1.

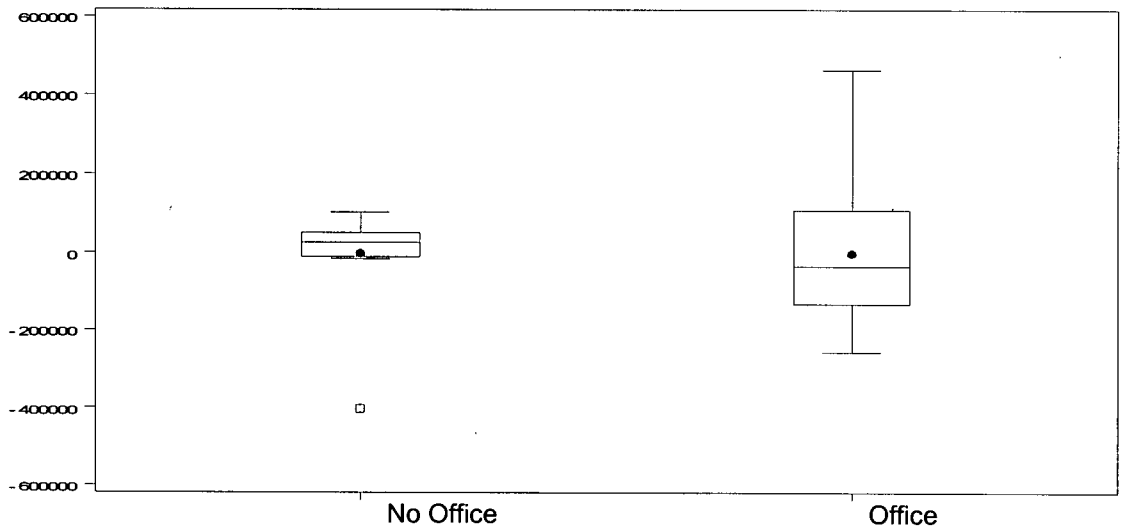
Table 3.6.1 T-test for Average Net Contributions Per Non-Discretionary Advisor

New Office	Mean Net Contribution	Standard Deviation	t – Value	Pr > ltl
0	- 39,771	120791	-7.13	< .0001
1	521,958	173973		

Our results give a P-value that is less than 0.0001, which is statistically significant at the alpha level of 0.05. Therefore, we can conclude that the Average Net Contributions from Calgary clients before and after the opening of the Calgary office is not equal. A Non-Discretionary advisor is estimated to have lost an average of $39,771/month in Net Contributions from Calgary clients before the opening of the Calgary office. After the opening of the Calgary office, a Non-Discretionary advisor is estimated to have accumulated an average of $521,958/month in Net Contributions from Calgary clients. This is a 1412 % increase in Calgary Net Contributions.

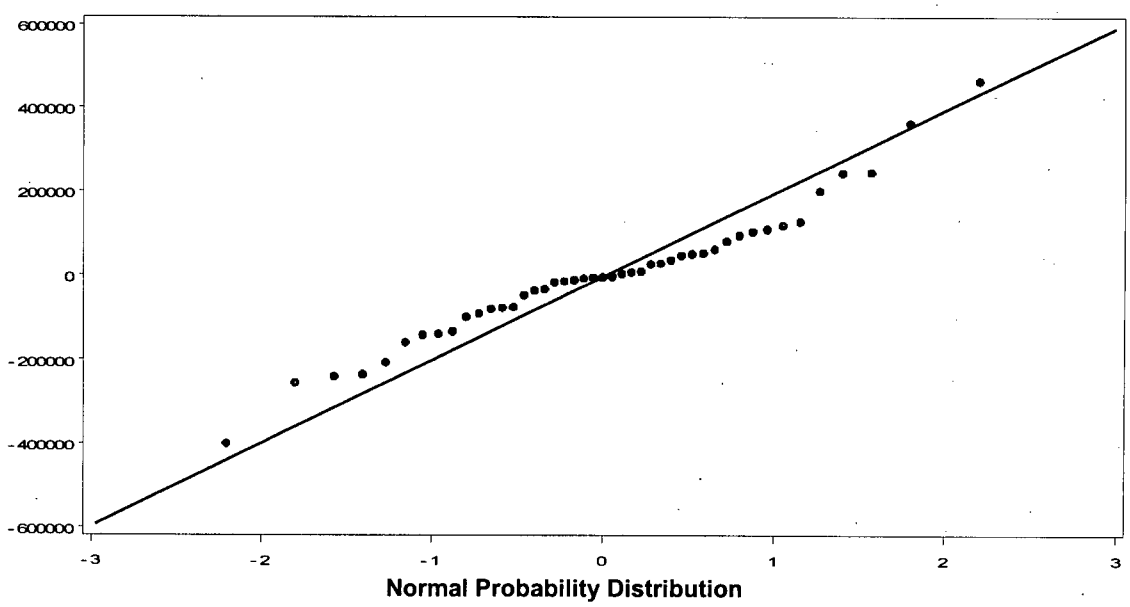
Residual analysis was conducted for the predictive model. Figure 3.6.2 show the variance in residuals for the predicted values. Figure 3.6.3 shows the normal probability plot of the residuals.

Figure 3.6.2 Residuals vs. Predicted values



From this graph we see that the variance in residuals for both predicted values are quite different. The variance appears to have increased after a new office is opened, violating the constant variance assumption of normality. The mean values of the residuals are both close to 0 confirming one of the assumptions of normality.

Figure 3.6.3 Normal Probability Plot of Residuals

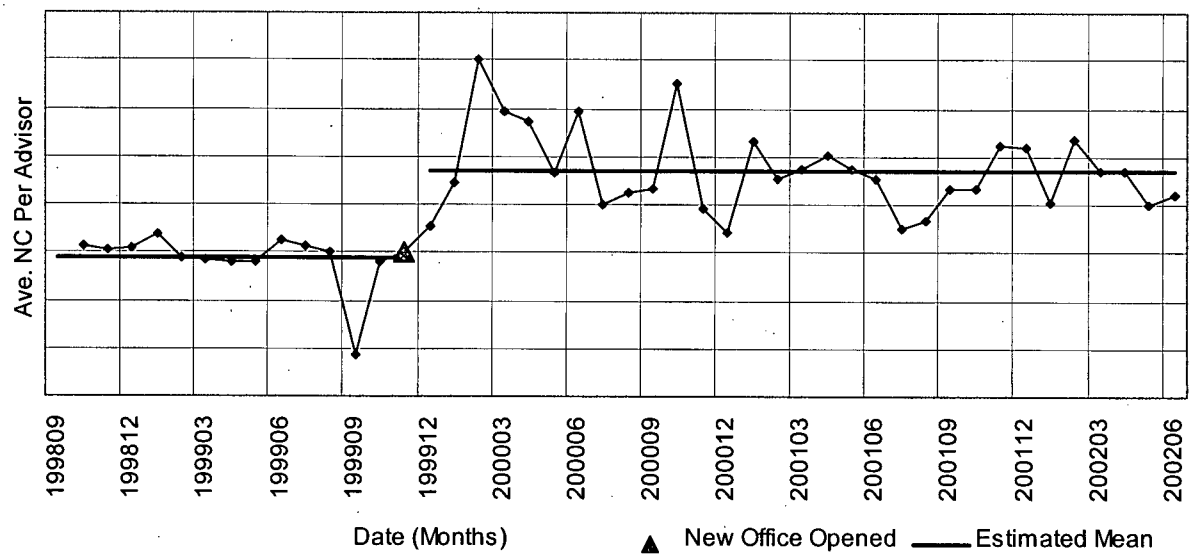


The normal probability plot of the residuals show that the residuals deviate slightly from Normal distribution.

Discretionary Advisors

All Discretionary advisors from Vancouver and Calgary, who managed Calgary clients were analyzed to determine if on average, an advisor has experienced increased contributions from Calgary clients from the period between October 1999 and May 2002.

Figure 3.6.4 Average Net Contribution Per Discretionary Advisor For Calgary Clients



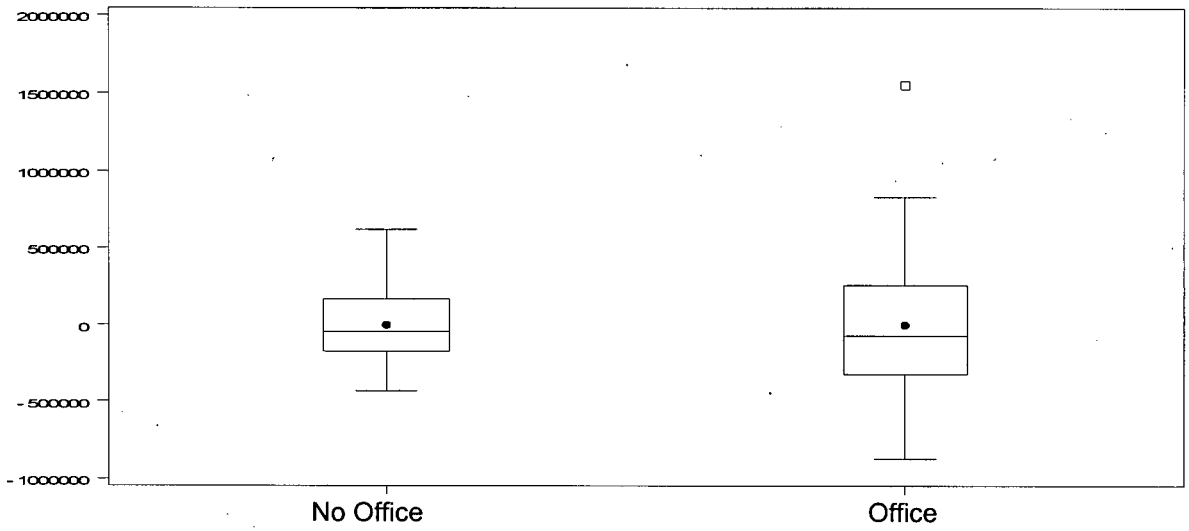
From the above graph we see that the variance in Net Contributions is increasing with time, thus a two-sample t-test with unequal variances was performed to test for differences in mean Net Contributions. Table 3.6.2 show the results of the t-test conducted with degrees of freedom calculated by the Satterthwaite approximation.

Table 3.6.2 T-test for Average Net Contributions Per Discretionary Advisor

New Office	Mean Net Contribution	Standard Deviation	t - Value	Pr > ltl
0	201,554	290,651	-3.64	0.0008
1	870,432	508,709		

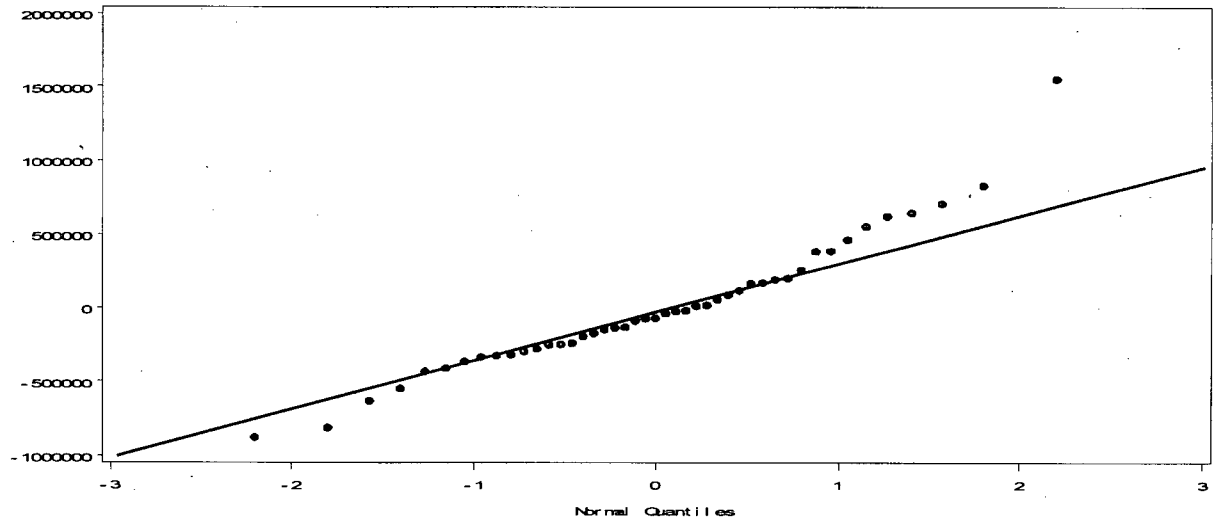
Table 3.6.2 shows a P-value of 0.008 is statistically significant at the alpha level of 0.05, thus we can conclude that the Average Net Contributions from Calgary clients after the opening of the Calgary office is not equal to the Net Contributions prior to opening the new office. An advisor acquired an Average Net Contribution of $201,554 per month from Calgary clients, compared to after the opening of the Calgary office, where an advisor is shown to have accumulated an average of $870,432 per month from Calgary clients. Thus after the opening of the Calgary office, there was an increase of 331% in Net Contributions from Calgary clients.

Figure 3.6.5 Residuals vs. Predicted Values



From this graph of the residuals, we see that the variance in the residuals is larger after the opening of a new local office, violating the constant variance assumption of the residuals.. The mean value of the residuals is close to 0.

Figure 3.6.6 Normal Probability Plot of Residuals



From the normal probability plot, we see that the residuals slightly deviate from the normal distribution. Particularly at the tails of the distributions appear to deviate from the normal providing further evidence that the residuals may not follow a normal distribution.

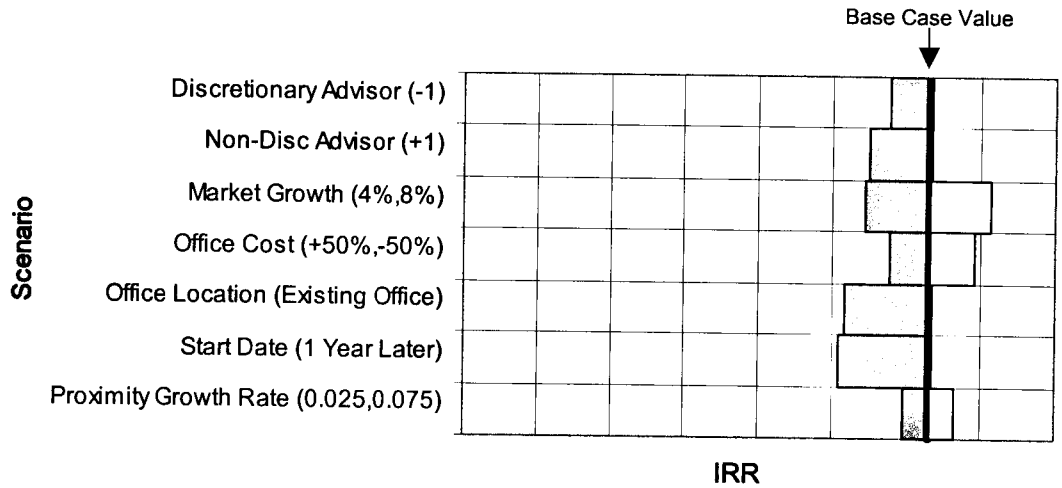
3.7. Profitability Model and Scenario Analysis Tool

In running several scenarios for the firm, we gained an understanding of the expansion plans generated from the scenario analysis tools. Management was particularly interested in how specific changes in the optimal recommendations affected their maximization criteria, internal rate of return[3]. The specific changes in the optimal recommendations that were studied are outlined below. This thesis discusses some of the preliminary observations gained from the scenario analysis tool and relates these findings to the business practices of the firm. For reference, the parameters of the model are shown in Appendix B.

We enlisted the help of the firm's management to determine a list of parameter changes that were the most relevant to their business practices. This included the occurrence of hiring one less Discretionary advisor, hiring one more Non-Discretionary advisor, a 2% increase or decrease to their projected market growth rate during the 10 year period, increasing or decreasing office costs by 50%, opening a local office in the foreign market, hiring additional advisors one year later than the optimal recommendations, and a 2.5% increase or decrease to the projected book growth rate, due to being in close proximity to their clients. By analyzing these changes, management would understand the variability in the expected profitability of each expansion plan. They would also understand the sensitivity of each variable on the expected profitability of each new expansion.

We ran the model and optimized several scenarios for different locations as well as different maximum quarterly cash outlays willing to be invested by the firm. Figure 3.7.1 shows a typical sensitivity analysis report resulting from the maximized scenario run.

Figure 3.7.1 Sensitivity Analysis On Maximized Internal Rate of Return



From our analysis, we observed that in general, it was more profitable to hire advisors earlier rather than later, despite the large investment of salary costs. The number of recommended

[3] Internal rate of return is used as the maximization criteria throughout this section although the scenario analysis tool can maximize over several other criteria.

advisors to hire is, thus, constrained on the maximum quarterly cash outlay the firm is willing to undertake. Our sensitivity report shows the effect of hiring advisors 1 year later than the suggested hiring plan found by our model. If this occurred, we the internal rate of return would decrease approximately 24%.

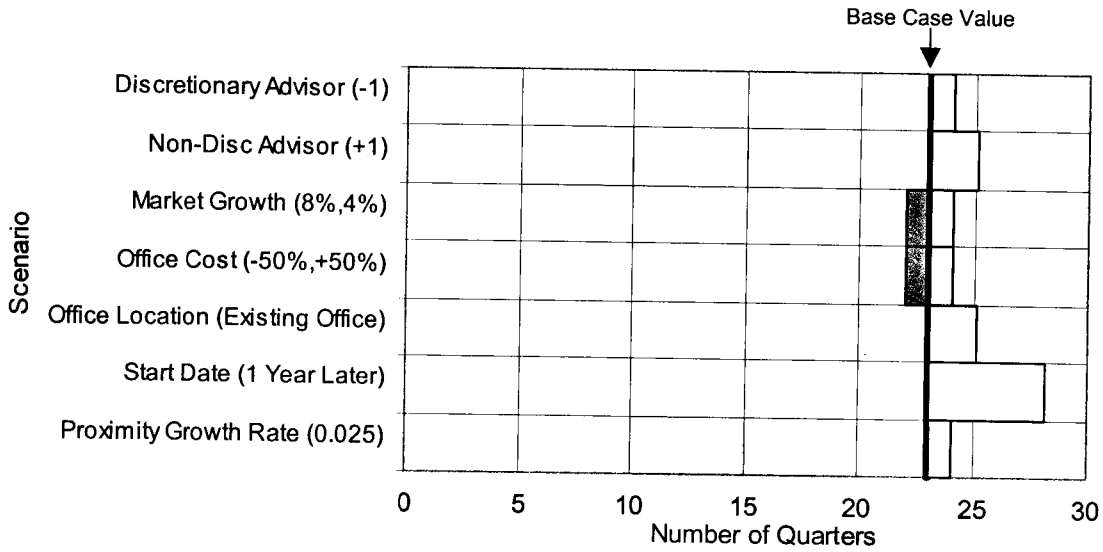
Notice that this variable is causing the most change from the optimal base case. During all our scenario runs, this variable was consistently one of the most sensitive variables influencing the internal rate of return.

Figure 3.7.1 also shows that the initial start-up cost of opening a new office is not very sensitive to the internal rate of return, as was initially hypothesized by management. Increasing the initial start-up costs by 50% only reduces the internal rate of return to 28.8%. This was invaluable to management who was reluctant to enter new markets as they felt the initial start-up costs would greatly impact their profitability.

We also observe that hiring one more Non-Discretionary advisor to the optimal hiring plan did not reduce the IRR greatly at 4.1%. The model, generally would advise to hire more Discretionary advisors and, in many cases, no Non-Discretionary advisors. As the Non-Discretionary business is a vital component of the firm, for servicing clients in close relation to their Discretionary clients but who do not meet the minimum requirement for Discretionary services, management wanted to understand how the hiring of a Non-Discretionary advisor to the optimal plan would impact their profitability. Therefore, despite the models recommendations, they would hire at least one Non-Discretionary advisor during the start-up of a new office. The results from the sensitivity report gave them a greater understanding of the impacts of their business decisions.

To further their understanding of their expansion scenarios, we also analyzed the results of the sensitivity analysis on the amount of time the expansion plan would take to financially breakeven. Figure 3.7.2 shows the sensitivity report on the time to breakeven.

Figure 3.7.2 Sensitivity Analysis On Time to Breakeven



Similar results were obtained for the expansion statistic, Time to Breakeven. We found that hiring additional advisors 1 year later greatly affected the time for the investment to breakeven. In this case, we see an increase from 23 quarters to 28 quarters. All the other scenarios did not change the time to profitability by more than one year.

We then wanted to analyze the quarterly amount of investment needed to implement the 10-year expansion plan. In particular, we wanted to determine how sensitive this figure would be to various changes to the original expansion plan. Figure 3.7.3 shows the sensitivity report of the maximum quarterly investment for an optimized expansion plan.

Figure 3.7.3 Sensitivity Analysis On Maximum Quarterly Investment

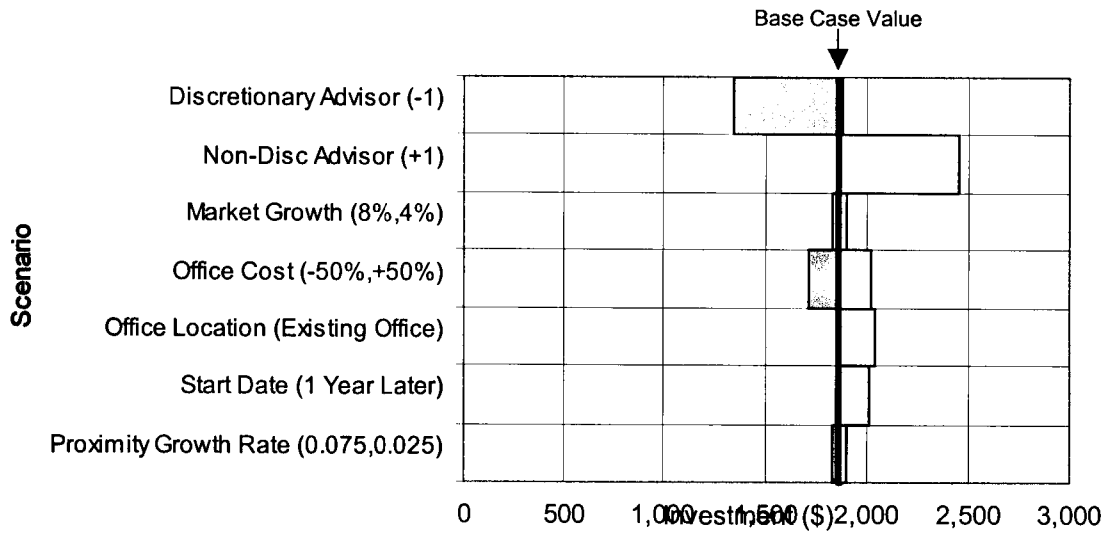


Figure 3.7.3 showed that the most influential variable to the maximum quarterly investment was the number of Discretionary and Non-Discretionary advisors hired. This result was interesting as it provided support for management's belief that advisor compensation was one of the largest determining factors for expansion planning. This result showed that the addition of a Non-Discretionary advisor or the subtraction of a Discretionary advisor to the new office changed the amount invested by approximately +$500,000, and -$500,000, respectively. The sensitivity analysis also showed that the initial start-up costs of a new office had a considerable impact on the maximum quarterly investment as an increase in initial office costs of 50% increased the maximum quarterly investment by $140,000. This increase was, however not as large as previously predicted by management.

The firm had previously modelled profitability and in general our analysis showed a slightly lower internal rate of return and a longer time to breakeven estimate compared to their results. This difference was a result of improved cost estimates in our model.

4. INTERPRETATION OF RESULTS

Our results have given insight into management's questions concerning the effect of specific drivers on revenue growth. We have shown that both Discretionary and Non-Discretionary advisors who proactively market to new clients obtain increased book growth compared to their Reactive counterparts. We have seen 31.24% more growth for proactive Non-Discretionary advisors and 3.8% more growth for Proactive Discretionary advisors over a 5-year period. This information gives the firm the statistical evidence to support their hypothesis and the confidence to begin hiring Proactive advisors.

Some of our statistical results regarding skill level affect on book growth contradicted managements beliefs. As management had categorized their advisors into High, Medium, and Low Skilled, they had assumed that our results would show that High Skilled advisors outperformed Medium Skilled advisors, while Medium Skilled advisor outperformed Low Skilled advisors. However, it was discovered that for Non-Discretionary services, advisors rated High Skilled showed no significant difference in performance compared to advisors rated Low Skilled. Whereas, advisors rated Medium Skilled outperformed both High and Low Skill rated advisors.

For Discretionary services, our results showed that both High and Medium Skill rated advisors outperformed Low Skilled rated advisors. However, Medium Skill rated advisors showed increased growth rate compared to advisors rated High Skilled. Our results show that the difference in book growth between High and Medium Skilled advisors was not a large as originally perceived. As Medium Skilled advisors were thought to perform well most of the time but not always consistently, it is possible that advisors are not being classified correctly.

Our results have given management confidence in their ability to assess advisor in terms of their marketing and in some ways their assessment of skill level. In hiring additional advisors to service new markets, they will aim to hire Proactive, High or Medium Skilled advisors.

In our analysis of positive press coverage on the firm, we have shown that there were significant increases for Vancouver and Toronto Non-Discretionary advisors and Calgary Discretionary advisors as well as for Calgary and 'Other' Unassigned clients following a favourable comment in a Nationally distributed newspaper on January 2001. We have also seen increases from Calgary Non-Discretionary advisors and Toronto Discretionary advisors following two articles in the November and December 2001 issues of a nationally distributed magazine. We cannot, however conclude that these events cause these increases but there does appear to be significant changes in Net Contributions for some advisors and Unassigned clients after these publications, which may or may not be attributed to the financial press coverage.

There is very substantial evidence that a local office in a targeted new market, impacts both the Discretionary and Non-Discretionary advisors accumulated client Net Contributions. A 1412% increases in Net Contributions is shown among Non-Discretionary advisors and a 331% increases in Net Contributions is shown among Discretionary advisors. However, it should be noted that we are comparing full time advisors who are placed in the local market to part time advisors outside of the target market. Therefore our results may be somewhat exaggerated.

Further analysis would be needed to compare a full time remote advisor to a full time local advisor, with respect the targeted market.

Based on our preliminary results, the firm should strive to open local offices in their targeted markets as there will be a greater realization of revenue and, as our results have shown, start-up costs of a new office does not drastically affect profitability.

The profitability model is currently being used by the firm to develop expansion plans to convince shareholders to invest in additional offices. As they are still in the planning phases, no results from their implementation can be assessed to determine how closely our model predicts actual outcomes. However, our model is currently being used to assess the expected profitability of several previously opened offices to determine whether our model is accurately predicting their realized profits.

5. SUMMARY

This paper discusses the findings from a collaborative study with the Centre for Operations Excellence at the University of British Columbia and a financial management firm. The firm is seeking to increase their market share of private investors in a number of Canadian cities. In order to determine the most profitable method of expanding their business to service additional clients, we developed a scenario analysis tool to analyze operational expansion strategies in terms of profitability. This allowed management to determine an optimal expansion and hiring strategy to service additional markets while generating the largest expected profit for the firm.

In addition to developing a profitability analysis tool, we analyzed and quantified the impact of several factors believed to impact revenue growth. These estimates allowed us to improve our forecasts of revenue growth and further customize the profitability analysis tool.

6. FUTURE DIRECTIONS AND COMMENTS

A further extension of our analysis of factors influencing client net contributions would be to analyze the impact on the growth of the number of clients serviced by the firm. This would allow us to understand how these factors influence their network of clients.

In our analysis of positive press coverage, a possible direction would be to consider fitting time-series models, with intervention analysis, to analyze the affect of positive press coverage on Average Net Contributions to the firm. This would allow us to not only see potential shift changes but also possible decaying effects throughout time.

Another further extension to our analysis would be to incorporate seasonality effects in the Cumulative Net Contribution growth models. This could potentially improve forecasting of revenue growth by reducing variation around our forecasts.

One issue that the reader should be aware of is that all the data used in our analysis was collected during a bull market. Thus, our profitability model assumes that Net Contributions to the firm are unrelated to the stock market conditions. Secondly, our models for Book Value growth do not incorporate seasonality effects on growth. Lastly, our profitability model does not incorporate any adjustments for tax effect on profitability, thus taxation issues should be incorporated into any expansion analysis.

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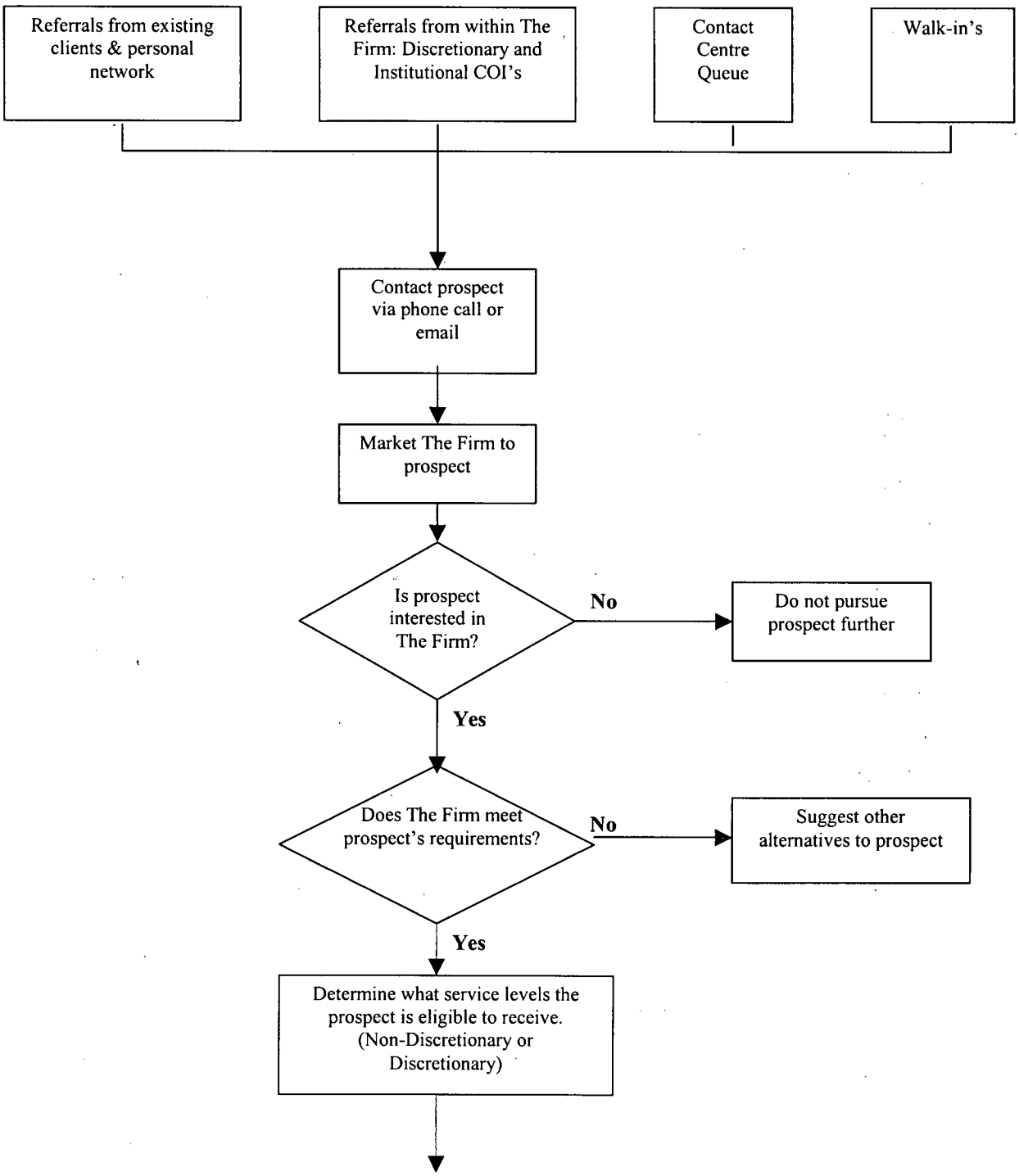
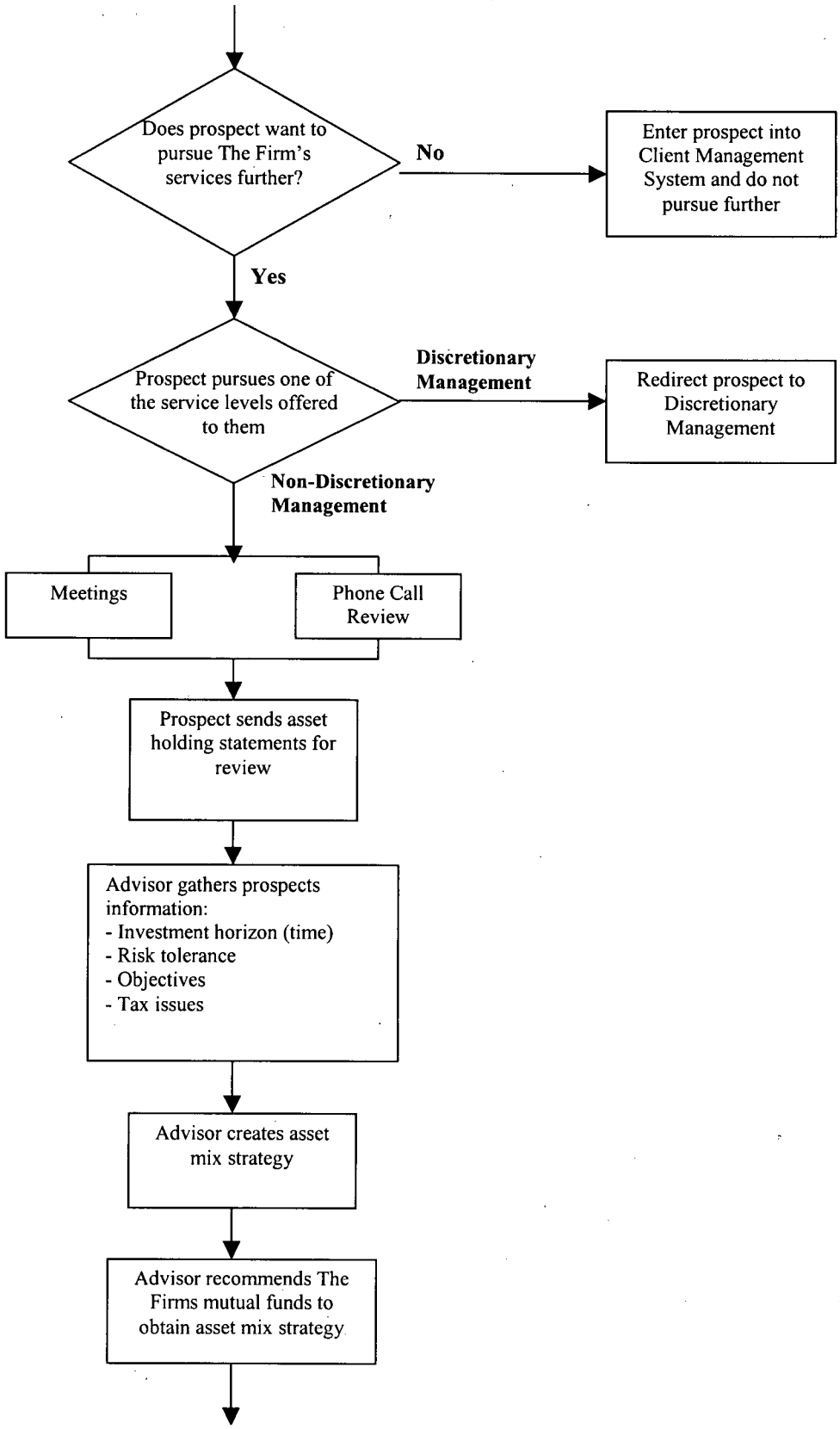
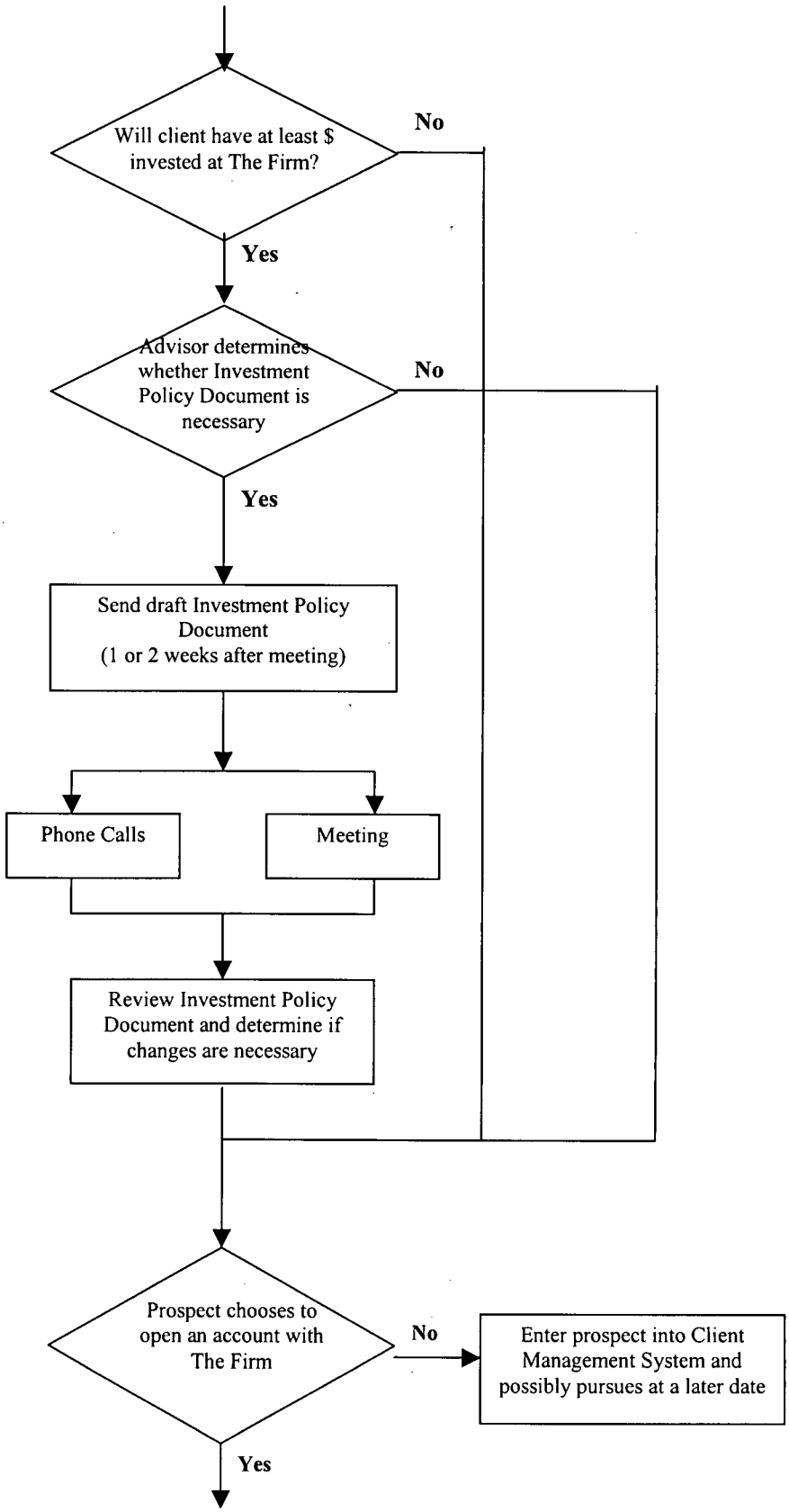
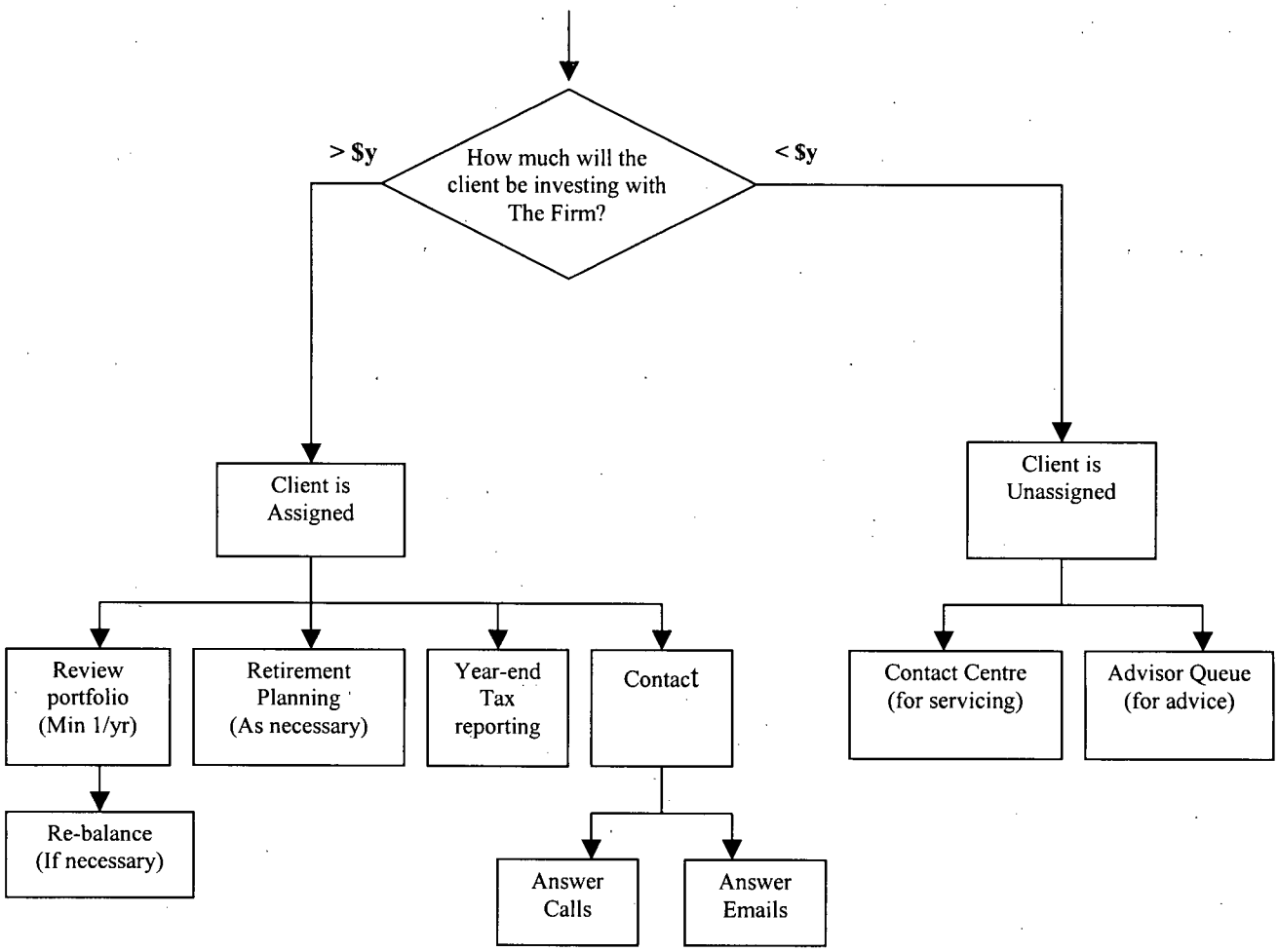
APPENDIX A PROCESS MAPS: CLIENT ACQUISITION

Non-Discretionary Advisors

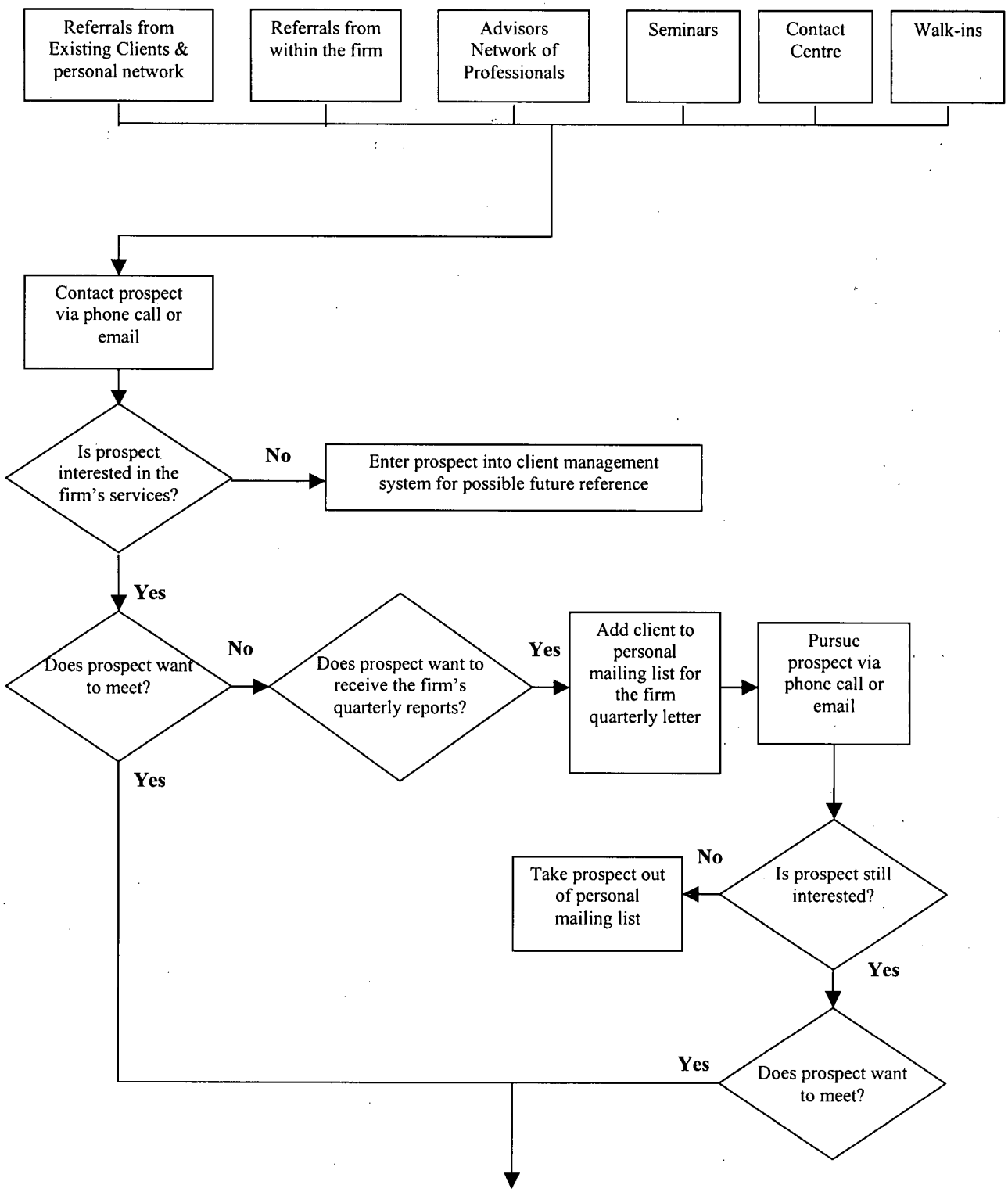


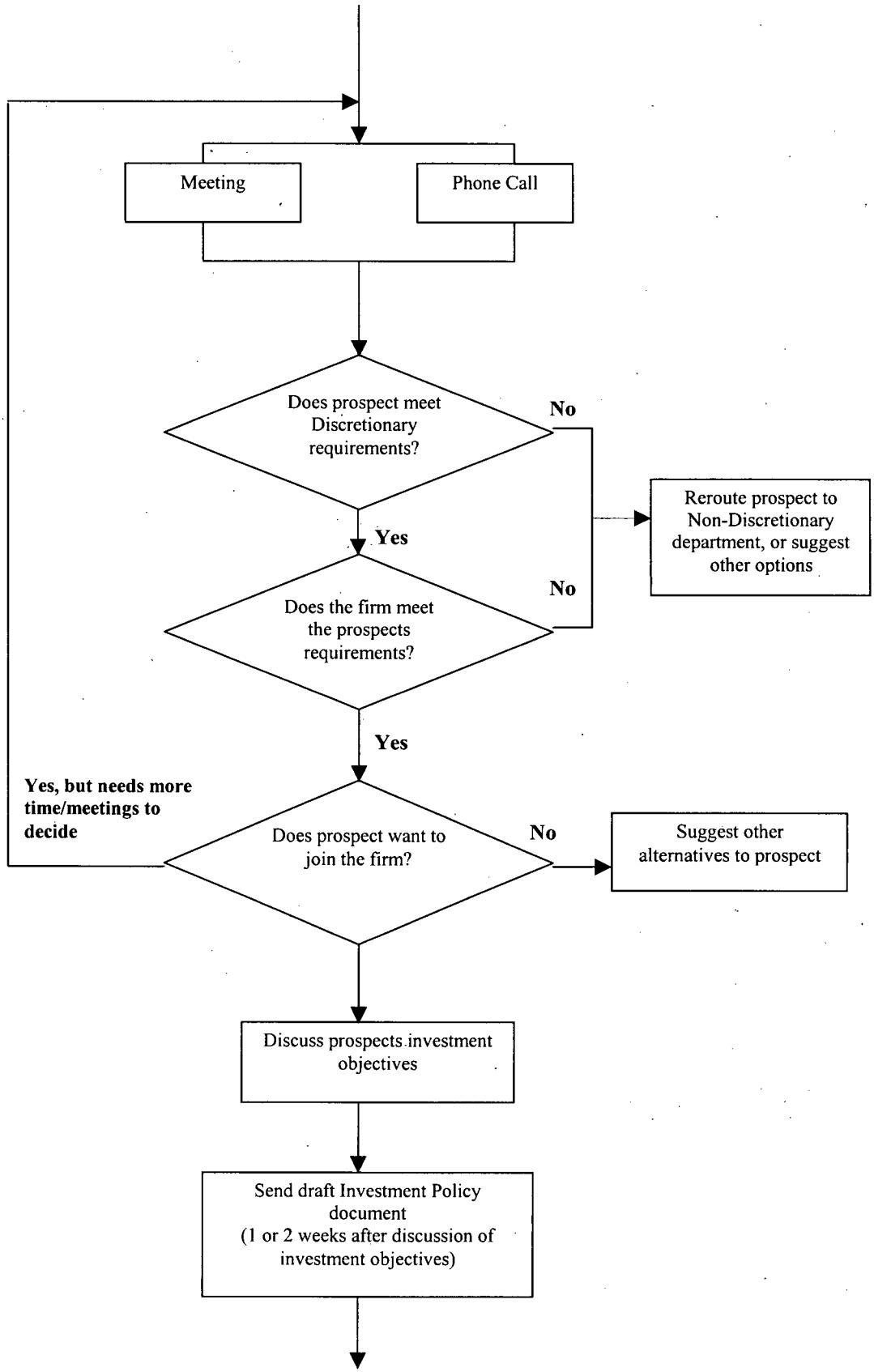

Does prospect want to pursue The Firm's services further?
No
Enter prospect into Client Management System and do not pursue further
Yes
Prospect pursues one of the service levels offered to them
Discretionary Management
Redirect prospect to Discretionary Management
Non-Discretionary Management
Meetings
Phone Call Review
Prospect sends asset holding statements for review
Advisor gathers prospects information:
- Investment horizon (time)
- Risk tolerance
- Objectives
- Tax issues
Advisor creates asset mix strategy
Advisor recommends The Firms mutual funds to obtain asset mix strategy

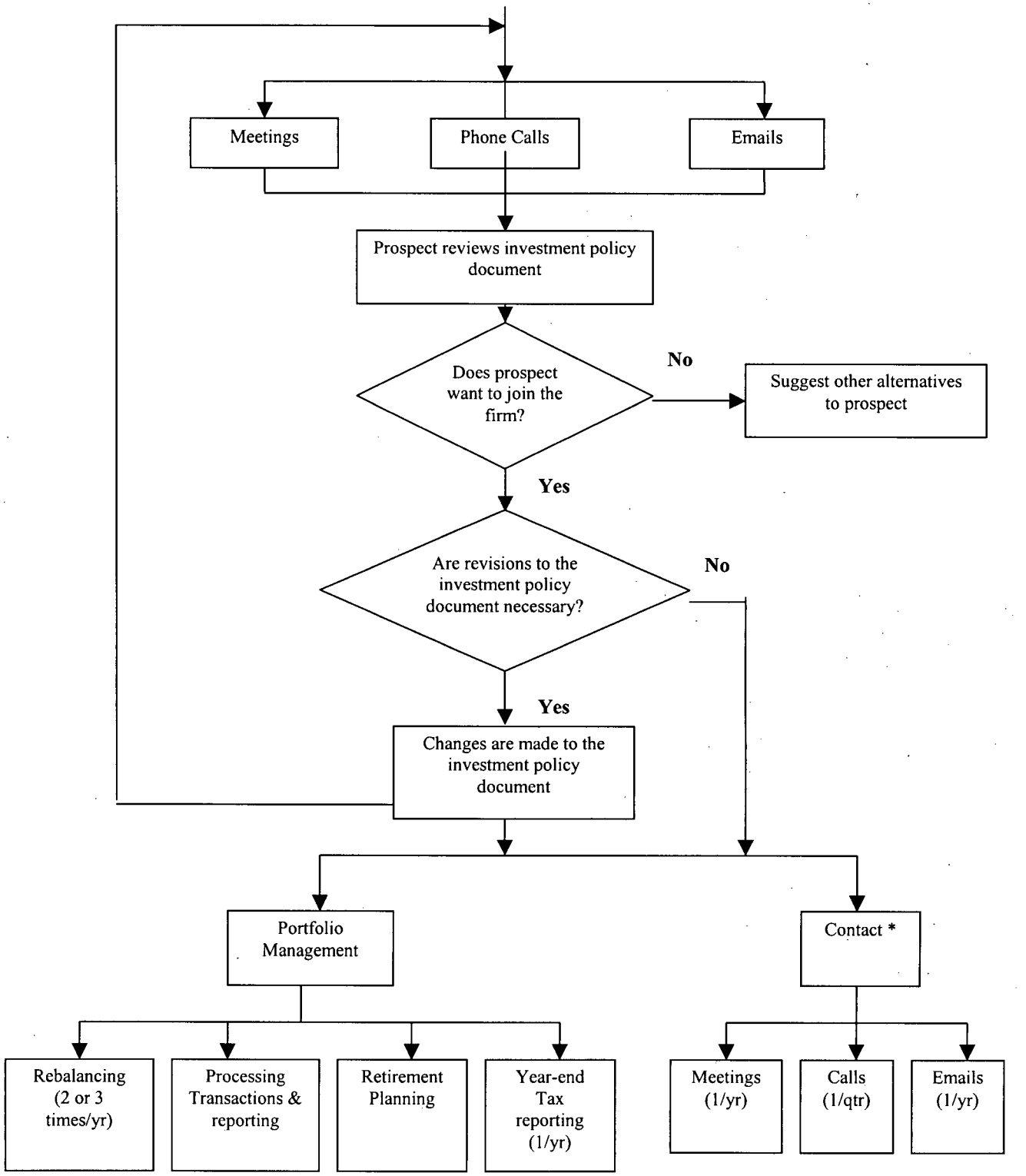

Will client have at least $ invested at The Firm?
No
Yes
Advisor determines whether Investment Policy Document is necessary
No
Yes
Send draft Investment Policy Document (1 or 2 weeks after meeting)
Phone Calls
Meeting
Review Investment Policy Document and determine if changes are necessary
Prospect chooses to open an account with The Firm
No
Enter prospect into Client Management System and possibly pursues at a later date
Yes


How much will the client be investing with The Firm?
> $y
< $y
Client is Assigned
Client is Unassigned
Review portfolio (Min 1/yr)
Retirement Planning (As necessary)
Year-end Tax reporting
Contact
Contact Centre (for servicing)
Advisor Queue (for advice)
Re-balance (If necessary)
Answer Calls
Answer Emails

Discretionary Advisors




Meeting
Phone Call
Does prospect meet Discretionary requirements?
No
Reroute prospect to Non-Discretionary department, or suggest other options
Yes
Does the firm meet the prospects requirements?
No
Yes
Yes, but needs more time/meetings to decide
Does prospect want to join the firm?
No
Suggest other alternatives to prospect
Discuss prospects investment objectives
Send draft Investment Policy document
(1 or 2 weeks after discussion of investment objectives)



*** Frequency of contact varies across Portfolio Managers and depends on how long the client has been with the Portfolio Manager**

APPENDIX B PROFIT MODEL PARAMETERS

Advisor Specific Parameters

Cost Item
Direct Discretionary Advisor Cost (excluding travel costs)
Discretionary Advisor Travel and Meals Cost
Indirect Discretionary Advisor Cost
Fixed Discretionary Cost (all offices)
Bonus and Fees
Discretionary Advisor Bonus on Cumulative Book Value (Quarterly)
Discretionary Revenue / Client Fees on AUM (Quarterly)
Start Dates
Discretionary Advisor 1 Start Date (Enter "-" if no start date)
Discretionary Advisor 2 Start Date (Enter "-" if no start date)
Discretionary Advisor 3 Start Date (Enter "-" if no start date)

Proximity

% Increase in Discretionary Net Contribution Growth Due to the Presence of a Local Office
% Increase in Non-Disc Net Contribution Growth Due to the Presence of a Local Office
Proximity (0 = Service market through an existing office; 1= Open new office in market)
Available Capacity in Existing Office (0 = No; 1= Yes)

Market Potential

Discretionary Market Potential
Discretionary Market Share as Percentage
Discretionary Market Share (Assets Under Management)
Non-Discretionary Market Potential
Non-Discretionary Market Share as Percentage
Non-Discretionary Market Share (Assets Under Management)

Inflation, Discount, and Growth Rates

Inflation Rate for Cost (Quarterly)
Discount Rate for NPV (Quarterly)
Discretionary AUM Market Growth Rate (Annual, City Specific)
Non-Discretionary AUM Market Growth Rate (Annual, City Specific)

Office Costs

Rent and Operating Costs Excl Insurance (Quarterly)
Premise Insurance (Quarterly)
Receptionist Salary and Benefits (Quarterly)
Office Furniture, Signage, Leaseholder Improvement (One-time)
Hiring and Business Planning Costs (One-time)
Alarm/Internet Office Cost (Quarterly)