Will Entrants into a Liberalized Delivery Market Attract Investors*

Robert Cohen
Matthew Robinson
Renee Sheehy
John Waller
Spyros Xenakis

Office of Rates, Analysis and Planning
U.S. Postal Rate Commission

February 2005

1.   INTRODUCTION

The purpose of this paper is to examine the question of whether entry into a liberalized letter delivery market would be attractive to venture capital investors. At the outset it should be recognized that such an enterprise would be quite risky. Competition by a startup against an established incumbent who enjoys significant scale economies could be quite difficult. For example, CityMail, an entrant against the incumbent Sweden Post, began operations in 1991 and has twice gone into bankruptcy. It has had several primary shareholders including most recently Norway Post and prior to that Royal Mail. While CityMail is currently profitable, we can say with perfect hindsight that it would not have attracted investors if its original business plan had been analyzed correctly by them.[1,2]

In this paper we develop a financial model of an entrant into the U.S. letter mail delivery market in order to evaluate the economic feasibility of the required investment. The cream-skimming model from our graveyard spiral paper (Cohen et al. 2004) provides inputs to the financial model. We conduct sensitivity analysis on the variables used in both models to determine their relative importance. We then calculate the internal rate of return (IRR)[3] for specific values of the most important variables. This provides insight into the likely success of an entrant in attracting adequate startup capital, which is a precondition for successful entry.

2.   THE SWEDISH EXPERIENCE

Sweden has the only liberalized letter mail market with an entrant that has garnered significant portions of the market. It thus provides the only source of information for a financial analysis of entry into a newly liberalized market. CityMail reports that it was in the black for the first quarter of this year and for the first time it is heading for a positive result for a full calendar year (2004).[4]

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[1]   Publishers Express in the United States is another delivery startup. It had an all star lineup of investors (including Time, Inc., Meredith Corp. American Express and R.R. Donnelly). Publishers Express delivered mail excluded from the letter monopoly for a couple of years before it folded in the mid-nineties.

[2]   An investment in a business like CityMail might be more attractive after bankruptcy than as a startup. This could happen if at time of bankruptcy the business had built significant scale or the startup losses were wiped off the books.

[3]   IRR is a standard financial measure used to evaluate investment opportunities. See Section 3.2 for a definition of IRR and Section 5.3 for a discussion of minimum values considered necessary to justify investments.

[4]   Email from CityMail, May 12, 2004.

Table 1: CityMail Volume and Shares
(1992-2003)

Year	Volume (Millions)	Share of Total Swedish Mail Volume	Year	Volume (Millions)	Share of Total Swedish Mail Volume
1992	18	1%	**1998**	152	4%
1993	19	1	**1999**	167	5
1994	29	1	**2000**	148	4
1995	36	1	**2001**	174	5
1996	54	2	**2002**	192	6
1997	116	3	**2003**	216	7

Average Annual Volume Growth

1992-2003	**25.6%**

Table 1 displays CityMail's growth and market share. Delivery operations began in 1991 with 1992 being the first complete year of operations. CityMail targeted bulk computer-generated mailings destined for the city of Stockholm. In 1996 service expanded to the areas surrounding Stockholm and to Sweden's second and third largest cities, Malmo and Goteborg. In 2000, service began to the surrounding areas of Malmo and Goteborg. A slight dip in volume occurred in 2000 as CityMail scaled back operations while new financing was being obtained. The Swedish postal regulator (PTS) has observed that "CityMail's [recent] increases in volume are from the Malmo and Goteborg areas, while the Stockholm volume is rather stable."[5]

The growth pattern exhibited by CityMail is fairly typical of new companies. It can be characterized by an initial period of slow growth followed by rapid expansion before leveling off as the entrant nears its maximum market share. The annual incremental growth often approximates a normal distribution and the cumulative growth an S-shaped curve. Figure 1 plots both the cumulative and incremental volumes for CityMail and it can be seen that the annual incremental curve has a normal shape and the cumulative curve is S-shaped.

Figure 1: Bass Model S-Curve Fit to CityMail Volume

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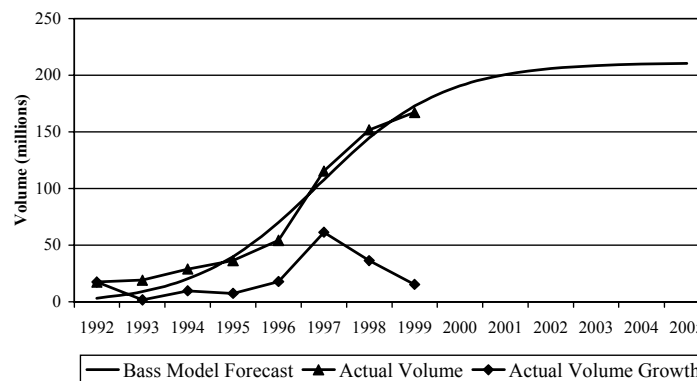
[5]   Email from Swedish postal regulator, May 14, 2004

A fit of a Bass business growth model to the initial growth cycle of CityMail in the Stockholm area is included in Figure 1.[6] CityMail estimates that the amount of bulk mail destined for the areas it currently serves is approximately 900 million pieces per year. After more than ten years of operation CityMail has been able to capture 216 million pieces of mail. Based on the Bass Model growth curve, volume for the market currently served should stabilize around 287 million pieces, which is slightly less than 30 percent of all bulk mail in the areas served by CityMail.[7] A spokesman from CityMail has observed that capturing "volume in this market is a very slow process. . . . one can expect a lot of conservatism among the customers. This is especially true about administrative mail (bank account statements, invoices, etc.). It takes time to prove your quality."[8]

CityMail currently delivers every third day on a rotating basis over the service area versus five days per week by Sweden Post. CityMail uses carriers that belong to the same union as the incumbent and they receive comparable compensation. Separate contract provisions reportedly allow flexibility to improve efficiency.

Some lessons can be drawn from the CityMail experience. Growth has extended over more than ten years and has reached approximately 24 percent of the bulk mail in its market. An upper bound of its market share is predicted to be about 30 percent. In addition, we can report that Sweden Post has differentiated its bulk mail tariff along geographical lines with lower prices in the cities served by CityMail. It maintains a uniform tariff for First-Class mail. Prices for single-piece letters have approximately doubled, whereas prices for bulk letters have remained roughly constant over the last decade. Sweden Post has reduced its employment by more than 40 percent since it began preparing for competition in 1990.

3. THE MODELS

Figure 2 presents a diagram of the interrelation of the two models and their parametric inputs. The *cream-skimming model* examines the 229,000 USPS delivery routes to determine the ones the entrant could serve profitably. It provides the fixed and variable costs of these routes and the revenue that the entrant would receive from them.[9] The *financial model* lays out a year-by-year projection of route profits/losses over the time period that it will take the entrant to reach its maximum level of profit.

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[6] To model the growth of the entrant, we use the diffusion model proposed by Frank M. Bass (1969). The Bass model describes the growth of new product sales as an S-shaped curve defined by coefficients for innovation, imitation, and total sales potential. See Section 4.6 for a discussion of the application of the Bass model.

[7] See Section 4.6 for a more detailed description of estimating the ultimate size of CityMail's market size using the Bass model.
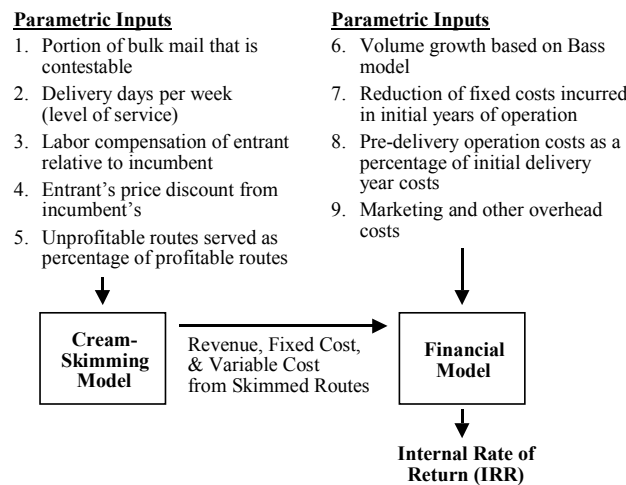
[8] Email from CityMail, May 12, 2004.

[9] In this paper we develop prices by upstream and downstream activities and by shape. We assume that all costs of upstream activities (mail processing and transportation) are recovered by upstream prices. See Appendix.

The model includes a parameter (#5) for unprofitable routes because we believe that an entrant would have to serve entire contiguous areas and could not serve only the profitable routes in an area. This is the pattern we observe with CityMail, which serves entire cities. Apparently, CityMail cannot simply serve profitable routes and turn over mail for unprofitable routes to Sweden Post, a model some observers think is feasible for entrants. We believe that several factors would prevent this as discussed in Section 4.5.

It should be noted that the model implicitly assumes that there are only two players in the market: the incumbent and the entrant. If a second entrant were to appear, then the model would overstate the IRR.

Figure 2: Inputs and Outputs of Cream-Skimming and Financial Model

Parametric Inputs
1. Portion of bulk mail that is contestable
2. Delivery days per week (level of service)
3. Labor compensation of entrant relative to incumbent
4. Entrant's price discount from incumbent's
5. Unprofitable routes served as percentage of profitable routes

Parametric Inputs
6. Volume growth based on Bass model
7. Reduction of fixed costs incurred in initial years of operation
8. Pre-delivery operation costs as a percentage of initial delivery year costs
9. Marketing and other overhead costs

Cream-Skimming Model → Revenue, Fixed Cost, & Variable Cost from Skimmed Routes → Financial Model → **Internal Rate of Return (IRR)**

3.1   Cream-Skimming Model

In our Graveyard Spiral paper (Cohen et al. 2004) we presented a model to calculate the total volume that an entrant would expect to skim from the incumbent under the assumptions implied by parametric inputs. The model uses data from U.S. Postal Service delivery operations to identify the routes on which an entrant will be able to price at a given discount from the incumbent's price and be profitable. The model assumes that on those routes the entrant skims all of the contestable mail.[10] The model reduces the incumbent's contribution to overhead by the amount lost due to the skimmed mail and calculates a new breakeven price for the incumbent. The remaining routes are examined at the new price to see which additional ones can be skimmed. The iterative process continues until equilibrium is achieved.

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[10] This is a "best possible case" assumption. It is highly favorable to the entrant. Just because an entrant can price its service below the incumbent does not mean that every mailer who sends contestable mail to the recipients on that route will switch. Considerations including the importance of frequency of delivery, dealing with a single vendor, loyalty to a vendor, the need for the entrant to prove quality, and the practical issue of physically transporting mail to the profitable routes from all over the nation make this assumption quite favorable to the entrant.

The entrant captures mail, not routes, from the incumbent. The incumbent is assumed to continue to provide service on all routes and satisfy all universal service obligations. The cream-skimming model can be viewed as an empirical model because it uses actual delivery route data to calculate the maximum possible volume or profit that an entrant could achieve at given values for the input parameters.

Significant improvements have been made in the revised version of the cream-skimming model. Most important is a shape-based delivery charge replacing the content-based charge.[11] See Appendix for further discussion.[12]

3.2   Entrant Financial Model

As with many startup businesses, the entrant can expect to lose money in the first few years of operation before reaching a period of sustained profitability. The viability of the business depends upon the final profit level, the magnitude and duration of unprofitable operations, and the risks involved. To evaluate a business for investment, disciplined investors look at the projected stream of cash flows and apply suitable discount rates to calculate the net present value of the stream, and this accounts for the time value of money.

To analyze the viability of the entrant's business model, we generate estimated cash flows over the life of the firm. Our model calculates revenue based on a constant percentage discount from the incumbent's price. Expenses include the fixed costs for each route served plus the variable costs of delivery (which are determined by the volume captured each year).[13] Expenses also include all capital equipment and space costs, which the model assumes are handled as leases.[14] In addition, an amount is added each year for marketing and administrative expenses equal to a percentage of annual revenue from the volume ultimately captured. The final year's profit, reflecting the ultimate state of the entrant, is valued as a perpetuity. The analysis thus includes the value of expected profits over the life of the firm.

Once the future stream of cash flows has been estimated, a metric must be applied to allow comparative analysis among scenarios and with competing investment opportunities. One of the most common methods of valuing a stream of cash flows is Net Present Value (NPV), where a discount rate is used to find the present value of the future cash flows. The appropriate discount rate is the return that investors will demand for their investment in the project, known as the project's *cost of capital*.

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[11]   Our colleagues at La Poste (Joëlle Toledano, Bernard Roy, Stephane Bernard and others) pointed out the distortions caused by content-based (subclass) pricing differentials, as opposed to cost-based (activity and shape) pricing. We also note that CityMail has a shape-based charge.

[12]   Further description of the models including a mathematical presentation and a comparison to our previous paper can be found in the Appendix.

[13]   At current USPS volume levels about half of route costs are fixed. Fixed cost as a percentage of total cost is inversely related to volume.

[14]   We use the depreciation expenses of USPS to approximate the rents paid by the entrant for the lease of equipment and facilities.

Estimating the cost of capital for the entrant presents many difficulties. For a specific project, it is largely determined by prevailing conditions in the capital markets (e.g., interest rates and inflation) combined with the perceived risk of the investment. As we have seen, gaining market share from an entrenched monopoly is difficult. In addition, the regulatory environment of a newly liberalized delivery market is likely to be prone to unforeseeable changes. Finally, given the widespread belief that First-Class mail volume per household in the U.S. has begun a permanent decline, the limited upside potential for long-term growth would also place upward pressure on the return demanded by investors.

Our model calculates the internal rate of return (IRR) of the entrant, which is the discount rate that results in a net present value of zero for a stream of future cash flows.[15] As such, it is the break-even discount rate, the rate at which the present value of cash outflows equals the present value of cash inflows.[16] If the entrant's cost of capital (discount rate) is less than the IRR, then the NPV of the venture is positive. Conversely, if the cost of capital exceeds the IRR then the NPV is negative, and the entrant's business model is not viable. The IRR allows the reader to judge whether the entrant's cost of capital will justify the investments necessary to enter the market. In the discussion of the results in Section 5.3 we will provide some guidance as to a reasonable range for the entrant's cost of capital.

4.   PARAMETRIC VARIABLES

Nine variables are used as parametric inputs in the interrelated cream-skimming and financial models. We select a base case value for each input and an optimistic and pessimistic value for use in a sensitivity analysis.

4.1   Contestable Mail

Single-piece mail is excluded from contestable volume since it would require an entrant to develop and invest in a collection and upstream infrastructure.

In Cohen et al. (2004), we defined as contestable the mail that could be presorted to the carrier route and dropshipped to a delivery unit or a regional sectional center facility (SCF). This corresponds to 30 percent of all bulk-entered mail delivered by the Postal Service in 1999 (Cohen et al. 2004, 126–129). The upstream market is competitive in the U.S. as a result of the Postal Service offering worksharing discounts equal to the costs it avoids. When a mailer or third party can reach the carrier route level of presort and dropship to the local (or regional) level with costs equal to or less than the Postal Service, it does so unless other overriding factors deter it. The most important factor is the need to present whole mailings to USPS in such a way that the delivery window can be estimated with a high degree of confidence. Whatever the reason, the market provides evidence that the volume of

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[15]   Since the stream of cash flows in every scenario changes sign only once, a unique IRR can be calculated.

[16]   The IRR is known by other names such as the Marginal Efficiency of Capital, True Yield, Interest Rate of Return, and Expected Rate of Return.

mail likely to be contestable for delivery by entrants is less than 30 percent of bulk mail.

The U.S.-based estimate is corroborated by the CityMail experience. CityMail estimates that it could in theory deliver all of the 900 million bulk-entered pieces of mail destined for the areas it serves this year, but experience to date demonstrates that this is not likely to occur. Some mailers may not be able to prepare their mail economically for delivery by an entrant such as CityMail, just as mailers in the U.S. currently do not find it economically feasible to take advantage of discounts for presorting mail to carrier route levels. In the absence of structural knowledge of the Swedish mail market, we estimate the contestable mail volume in the markets served by CityMail to be the maximum volume predicted by the Bass model. It was calculated in Section 2 to be 287 million or slightly less than 30 percent of all bulk mail in the market. This matches our U.S. base case (i.e., 30 percent of all bulk mail is contestable). To explore the sensitivity of the IRR to the amount of contestable mail, we analyze situations where the percentage of bulk mail considered contestable ranges from 15 percent to 100 percent.

4.2   Delivery Days (Level of Service)

The entrant can reduce its fixed costs by reducing the number of days a week on which delivery occurs.[17] The model is designed to allow for any number of delivery days ranging from one to six. The most pessimistic case for the entrant is delivery six days a week, the middle value is every other day (three times a week) and an optimistic value is delivery twice a week. It should be noted that delivery days are related to the amount of contestable mail. Many mailers of bulk mail require next day service or delivery more rapidly than a reduced number of delivery days would allow.[18] Thus, it would seem that the higher the percentages of contestable mail the more frequent the delivery.

4.3   Labor Compensation

The entrant can also reduce costs relative to the incumbent by paying its employees less. It is not obvious that this will occur as Sweden Post and CityMail draw upon labor from the same labor union at similar compensation rates. Likewise, the compensation paid to delivery personnel by UPS and FedEx in the U.S. is not below that paid by the Postal Service. In some countries, such as the United Kingdom, the incumbent already has low compensation rates that may be difficult for an entrant to undercut. Yet, in many countries it is likely that the entrant's labor will be compensated at a rate lower than the incumbent's. For this reason, the model uses entrant labor costs that are 100 percent (pessimistic case), 90 percent (base case) or 80 percent (optimistic case) of the incumbent's labor compensation costs.

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[17]   In the U.S. delivery is six days a week, but many countries deliver only five days per week. Some deliver even fewer times per week to some rural areas.

[18]   Delivery less frequent than every day implies the delivery of some mailings would be staggered, as carriers serve different routes depending on the day of the week. This also would reduce volume, as some mailers require all items to be delivered on the same day.

4.4   Entrant's Price Discount

The cream-skimming model assumes that the entrant offers delivery services at a discount from the incumbent's uniform price in order to attract customers. Because the entrant follows an umbrella pricing strategy, both the incumbent's and the entrant's prices will increase over time as the entrant skims increasing amounts of mail and forces the incumbent to raise prices in order to break even. This price adjustment occurs on each iteration of the cream-skimming model. In the analysis presented here we examine price discounts of 5, 10, and 15 percent with 10 percent taken as the base discount. The cream-skimming model caps the entrant's final price at twice the initial price. Higher prices would attract additional entrants that would in turn lead to lower prices.

4.5   Unprofitable Routes

The entrant ideally would like to delivery mail only on routes where it makes a profit. Theoretically, this could be accomplished in two ways. The entrant could accept mail only for recipients on profitable routes in a given contiguous area or it could accept mail for the entire area and turn over mail on unprofitable routes to the incumbent. In reality neither option seems practical, and an entrant would be forced to serve some unprofitable routes. An important concern of many mailers is maintaining the integrity of their product before delivery to ensure a given delivery day or window. Thus, having different delivery providers handle a mailer's product in an area is unlikely. Additionally, neither the mailer nor the entrant could take full advantage of the incumbent's upstream presort discounts if only some of an area's volume was given to the incumbent. [19]

CityMail has employed an area-by-area strategy, first Stockholm, then its suburbs, then the next two largest cities. Area-by-area delivery would also be feasible in the U.S. since large numbers of high-income families, and thus high-volume mail recipients, tend to cluster in and around the major population centers. These areas primarily contain profitable routes on which an entrant could expect to profitably capture contestable mail. These would be the primary service areas for the entrant. It would be advantageous for the entrant to serve areas corresponding to those designated by the five-digit ZIP code, the basis for many presort discounts. Taking all mail for such areas would preserve the upstream presort discounts a mailer could earn.

The cream-skimming model ranks all routes according to profits from the most profitable to the least. The result is the curve displayed in Figure 3 which has a relatively small number of routes with large profits and losses (the tails of the figure) and a broad, flat middle section in which losses are close to zero. The model assumes that the entrant will provide service on a number of unprofitable routes equal to a certain percentage of the number of profitable routes it serves, starting with the least unprofitable routes (i.e., in Figure 3, the routes in the region immediately to the right of the point where the profit curve crosses the horizontal axis). This assumption is quite favorable to the entrant since it implies the entrant will not have to serve highly or even moderately unprofitable routes. The base case

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[19]   The level of presort depends on density which in turn is a function of volume.

assumes that the entrant serves one third as many unprofitable routes as profitable routes. The pessimistic case assumes half as many unprofitable routes as profitable routes, and the optimistic case assumes one fourth as many. To account for the need to provide service on these unprofitable routes, profit is adjusted downwards in the financial model by subtracting the losses generated by serving them.

Figure 3: Routes Ordered by Entrant's Profit (Base Case)
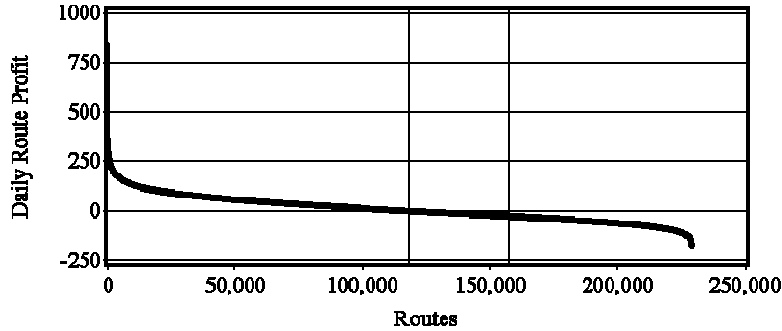
4.6   Volume Growth Based on Bass Model

Based on the experience of CityMail and entrants in other industries, we assume that the entrant's volume growth will follow the Bass model (1969). The annual volume of the entrant is defined as

$$Y(t) = mF(t) = m\left(\left(1 - e^{-(p+q)t}\right)\big/\left(1 + (q/p)e^{-(p+q)t}\right)\right)$$

where *p* is the coefficient of innovation, *q* is the coefficient of imitation, *m* is the entrant's final volume, and *t* is the time period.

The values of *p* = 0.00981, *q* = 0.71706, and *m* = 210.9 million[20] are estimated econometrically by fitting the above equation to CityMail's annual volume data from 1992 through 1999. Volumes from 2000 to 2003 are excluded from the estimation process because during this time CityMail underwent changes that affected the pace of its expansion. Including these years would preclude the selection of a single S-curve Bass model to fit the volume growth of CityMail. Figure 1 shows a comparison of the actual and forecast volumes.

In each scenario, the maximum potential volume (MPV) of the entrant is substituted for *m*, with *p* and *q* held constant at their estimated values. The volume forecast by the fitted Bass equation for Year 10 exceeds 95 percent of the final amount captured (i.e., MPV). The financial model assumes that in Year 11 and beyond the entrant fully captures the MPV.

To evaluate the sensitivity of the IRR to the speed with which the entrant captures volume, we also use five and fifteen years to capture 95 percent of the

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[20]   The estimated maximum volume for CityMail (287 million) cited in Section 2 is calculated by increasing this estimate (211 million) in proportion to the increase since 1999 in households served by CityMail.

MPV. In the five-year scenario, the value of each *t* is divided by 0.5, and in the fifteen-year scenario it is divided by 1.5. This maintains the shape of the S-curve while compressing the growth period to five years or extending it to fifteen years.

4.7   Reduction of Fixed Costs in Initial Years of Operation

If the entrant is assumed to start operations on all routes that eventually will be profitable, the entrant will encounter the same total fixed costs in each year of operation as delivered volume slowly builds.   This is the major source of unprofitability in the initial years. Faced with the prospect of large losses for several years, the entrant might find ways to reduce the fixed costs in the early years of operation by altering the route structure.   To accommodate these potential adjustments in route structure, we build up the fixed costs in the early years gradually.   For the base case, where the period of growth to achieve maximum potential volume is assumed to be ten years, fixed costs for the first, second, third, and fourth years of delivery operations are set at 20, 40, 60, and 80 percent respectively to obtain a reduction.   For the five-year growth period, the reduction factor for the first and second years of delivery operations is set at 40 and 80 percent. For the fifteen-year growth period, the initial year factors are set at 20, 30, 40, 50, 60, 70, 80, and 90 percent. For a given growth period, these factors are not varied in the sensitivity analysis.

4.8   Pre-delivery Operation Costs

New business operations do not start instantaneously; they require a pre-operational period.   The cost of this would be significant for a postal delivery operation.   These costs include marketing and sales, hiring and training a large number of letter carriers, setting up a transportation network, and acquiring facilities and sorting equipment.   The model uses 25 percent of the total costs in the initial year of delivery operations as an estimate of pre-operation costs.   Fifteen percent and 35 percent are the optimistic and pessimistic values.   This variable is strongly attenuated by the *reduction of fixed cost in the initial years of operation*.

4.9   Marketing and Other Overhead Costs

The cream-skimming model uses only the direct and overhead costs associated with delivery to determine whether the entrant will capture the contestable mail on a route.   In other words, it assumes bare-bones operations without marketing, administrative, or other non-delivery overhead costs that a business must incur. To make the analysis more realistic, these non-delivery costs, expressed as a percentage of revenue, are included as a parametric input variable in the financial model.   The base case value is 10 percent of projected revenue on profitable routes when the entrant's maximum level of volume is achieved.   The pessimistic case value is 15 percent and the optimistic value is 5 percent. These costs are reduced in the early years of operation by the same factors applied to fixed delivery costs.

5.   RESULTS

5.1   Sensitivity

Above we discussed each variable and its pessimistic, middle, and optimistic value. We designate the middle values as our base case. Table 2 displays these values.

Table 2: Values of the Model Inputs Used in Sensitivity Analysis Variables

	Pessimistic	Base	Optimistic
Contestable Mail (percentage of delivered bulk mail)	15%	30%	65%
Growth Period (years)	15	10	5
Marketing & Other Overhead (percentage of maximum annual revenue)	15%	10%	5%
Delivery Days	6	3	2
Unprofitable Routes (percentage of profitable routes)	50%	33%	25%
Labor Compensation (percentage of incumbent's)	100%	90%	80%
Entrant's Price Discount (percent)	15%	10%	5%
Pre-delivery Operation Costs (percentage of Year 2 costs)	35%	25%	15%

The variables are listed in the order of their impact on the sensitivity of the IRR. Table 3 displays the IRR when an optimistic or pessimistic value for a variable is substituted *ceterus paribus* into the base case (which has an 9.5% IRR).

Contestable volume is the most important variable. The optimistic value causes a more than three-fold increase in the base case IRR. It can be seen that changes in the values of this variable cause decidedly non-linear changes in the IRR.

Growth period is the next most important variable. The IRR doubles in the optimistic case as compared to the base case. Again, the effect on the IRR of changes in the values of this variable is also highly non-linear.

**Table 3: Sensitivity of IRR to Changes in the Values
of the Inputs Variables[a]**

Benchmark	9.5%	
	Pessimistic	**Optimistic**
Contestable Mail	7.1%	32.1%
Growth Period	6.7	19.1
Marketing & Other Overhead	6.9	12.5
Delivery Days	7.3	12.0
Unprofitable Routes	7.0	10.8
Labor Compensation	8.5	10.7
Entrant Price Discount	8.9	10.1
Pre-delivery Operation Costs	9.5	9.6

[a]   The IRR is displayed for a change (from the base case) in a single
    variable.

The IRR is much less sensitive to changes in the remaining individual variables, but, as is seen in the next section with *delivery days*, there can be significant interaction with the *contestable volume* variable. Thus, estimating the amount of contestable volume and the number of years necessary for the entrant to achieve its maximum volume are most important in evaluating an investment in the venture. A complete sensitivity analysis would examine changes in all combinations of variables, and some variables would exhibit greater variation than shown in Table 3.

## 5.2   Selected Business Strategies

In this section, the model is used to analyze scenarios of general interest involving various combinations of the input variables. In all cases we assume that the growth period to achieve maximum potential volume in the area served is ten years. We believe shorter time periods are overly optimistic and longer time periods are of little interest to most investors because of the lower IRRs that result. Table 4 presents the results of the model assuming 18 combinations of two significant parameters: the amount of contestable mail and the number of delivery days. The resulting IRRs are also displayed as a surface graph in Figure 4. As the contestable mail increases, the sensitivity of the IRR to the number of delivery days increases as can be seen from the slope of the surface for contestable mail corresponding to percentages of bulk mail greater than 65 percent.[21]

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[21]   An exception to the monotonic changes in IRR in Figure 4 occurs at the extreme point
    corresponding to low contestable volume and six-day-a-week delivery. This is due to the fact that
    in this scenario only routes with extremely high profits are skimmed. When a profit curve similar
    to Figure 3 is produced for this case, the entrant captures primarily the vertical part of the curve.
    The profitability of these routes may be exaggerated due to the use of average costs for the city
    carrier routes in the cream-skimming model.

Table 4: Internal Rate of Return Resulting from Varying the Level of Contestable Volume and the Number of Delivery Days

Contestable Mail Volume (% of Delv. Bulk)	Delivery Days		
	2	3	6
18 billion (14.7%)	7.6%	7.1%	14.1%
36 billion, benchmark (29.4%)	12.0	9.5	7.3
46 billion (37.6%)	20.8	11.6	8.0
78 billion (64.2%)	41.5	32.1	13.2
102 billion (83.3%)	47.2	38.2	21.6
122 billion (100.0%)	51.0	42.4	26.1

Figure 4: Internal Rate of Return (IRR) Resulting from Varying the Level of Contestable Volume and the Number of Delivery Days
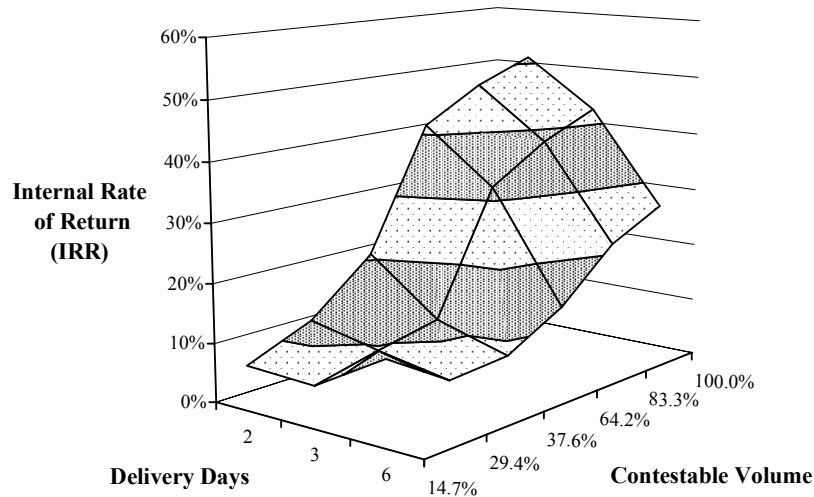
If the amount of contestable mail is greater than 65 percent it is reasonable to expect that the entrant will have to provide a high quality of service and make sizeable expenditures in marketing. To reflect this situation, a stand-alone scenario is modeled where the amount of contestable mail is very optimistic (65 percent of bulk) but other variables assume pessimistic values (6-day delivery, 15 percent price discount, 100 percent of incumbent's labor compensation, 15 percent of revenue allocated to marketing and administration, and first year costs at 35 percent of Year 2 costs). The model produces an IRR of 8.5 percent for this high-volume scenario.

On the other hand, a market with low or very low contestable volume suggests a possible niche service in which service quality and marketing costs are less than in the base case. Model inputs reflecting this scenario are contestable mail at 15 percent of bulk volume, 2 delivery days per week, 5 percent price discount, 80 percent of incumbent's labor compensation, low marketing expenses at 5 percent of eventual revenue, and low first year costs at 15 percent of Year 2 costs. This niche market scenario produces an IRR of 11.7 percent.

Interestingly, the large contestable mail and niche market scenarios have similarly low IRR values yet they would require substantially different operations with substantially different capital requirements and profits.

5.3   Assessing Model Results

In order to interpret the results of the models presented here, it is necessary to put the calculated IRRs in context. In each of the scenarios, the entrant experiences losses in the early years of operation before reaching profitability as delivered volume grows. Therefore upfront capital is needed to cover the losses in the early years of the project. This capital may come from a number of potential sources, but regardless of the source, the project must compete for capital resources with other investment opportunities. To successfully attract the necessary capital investment, the entrant must pay an adequate return to the investors. From the entrant's point of view, this is the cost of capital for the project. As discussed in Section 3.2, if the project's IRR exceeds its cost of capital, then it can be considered viable; if not, the returns will not be sufficient to attract investment. In this way, the cost of capital for a project can be viewed as a hurdle rate that must be exceeded by the IRR.

The required rate of return for investment in a project (i.e., the project's cost of capital) compensates the investor not only for inflation and the time value of money, but for the relative risk of the investment as well. As discussed in Section 3.2, an entrant to the postal delivery market would face substantial risks in challenging a well-established monopoly with huge scale economies for a contestable market of unknown size while taking on considerable regulatory risk.

Many startup businesses receive early stage financing from venture capital firms. In consultations with Wall Street venture capital analysts regarding investments in startups, we have been told that the minimum return that would be required (i.e., the entrant's cost of capital) in the current investment environment is 25 percent, and could exceed 40 percent depending on the perceived risk.[22] Greater uncertainty in the estimates of the models' variables implies greater risk, and therefore a higher required rate of return (cost of capital). Business scenarios treating sizeable portions of bulk mail as contestable may produce relatively high IRRs, but the risk is also greater. For instance, experience to date in the U.S. with worksharing discounts provides evidence that the maximum amount of contestable mail for an entrant (i.e., bulk mail that can be economically carrier route presorted and dropshipped regionally) is less than 30 percent of the delivered bulk-entered mail. Assuming a higher percentage would represent a significant risk in the calculation of the IRR.

Based on venture capital market requirements, our models predict that an entrant must have a contestable mail market that is greater than 60 percent of all bulk mail delivered in the geographic area served. Capturing this amount of mail would likely require sizeable startup and marketing costs, with deep discounts, and better service, which implies everyday delivery by skilled staff paid at compensation rates equal to the incumbent's. All these factors contribute to lowering the IRR to 8.5% percent. This is similar to the IRR that a niche market entrant would achieve, but with much higher capital requirements and profits in absolute terms.

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[22]   If an entrant were not a startup firm, but a new division of an existing company, its cost of capital would likely be somewhat lower. A well-run firm with experience in the area of entry would have a lower risk and hence a lower cost of capital. However, it is likely that the cost of capital for this type of project would still be high.

While the estimated IRRs demonstrate that it will be very hard for an entrant to attract the necessary capital and thereby limit competition for an incumbent post, liberalization can still affect the postal delivery market in several ways. On the positive side, if competition does develop, even in a limited market, it can lead to innovations in service, giving more choices to customers. More importantly, even the mere threat of competition can lead incumbents to cut costs and to improve efficiency and service. On the other hand, entry will cause a loss of scale economies. The issue is whether the gains in innovation, efficiency, and service quality outweigh the costs of entry.[23]

6.   CONCLUSIONS

Based on the results given above, we make the following conclusions concerning the potential for obtaining venture capital for an entrant delivery service.

1. It is unlikely that a realistic business plan will attract capital for an entrant delivery service in a liberalized postal market with characteristics like the U.S. market. Thus, liberalization is unlikely to trigger a graveyard spiral.

2. In order to achieve an IRR sufficient to attract venture capital, about two thirds of bulk mail would have to be contestable. This is highly unlikely.

3. The most significant variables in a business plan are:
    a. the amount of contestable mail in the market served
    b. the rate at which the business grows to its maximum volume
    c. marketing and overhead expenses as a share of revenue
    d. the number of days of delivery per week.

More scenarios can be examined with the models presented here. In addition, the models can be enchanced with new input variables for future research.

APPENDIX A: THE MODELS

A.1   Cream-Skimming Model

The cream-skimming model used here is a modified version of the model originally presented in Cohen et al. (2004). An important improvement in this version of the cream-skimming model is the use of cost-based prices by activity and shape instead of full-service, content-based subclass prices. This affects the revenue from contestable mail and the loss of delivery profits by the incumbent as a result of cream skimming.

Content-based subclass prices cause the price of contestable mail to be artificially low. By using cost-based prices for delivery of three mail shapes (letters,

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[23]   For more discussion of the tradeoff in positive and negative impacts of liberalization, see Cohen et al. (2004) and Cohen and Chew (1997).

flats and parcels), we have eliminated the downward distortion in the price of contestable mail caused by subclass prices.

The higher delivery prices for contestable mail enable the entrant to capture more mail. They also increase the delivery profit lost by the incumbent for a given amount of captured volume. The combined effect of the new activity- and shape-based pricing is to make cream skimming more painful for the incumbent. Our conclusions in Cohen et al. (2004) remain largely unaffected.

A.1.1 Model Overview

1. The model examines individual routes to identify the ones where an entrant can profitably deliver the contestable volume.

2. The incumbent's profit from these routes is reduced by the contribution to overhead from the lost contestable volume.

3. The incumbent's delivery prices are raised to recover the profit lost to cream skimming and the subsequent effect of demand price elasticities.

4. The rise in the incumbent's delivery prices creates additional cream-skimming opportunities for the entrant. The model returns to step 1 until equilibrium is achieved.

A.1.2 Notation and Definitions

i Denotes a shape of mail

M = Number of mail shapes (1=Letters, 2=Flats, 3=Parcels)

j Denotes a USPS delivery route

N = Number of USPS delivery routes

q_{ij} = Volume of shape i delivered on route j

Q_j = $\sum\limits_{i=1}^{M} q_{ij}$ = Volume of mail delivered on route j

QDM = $\sum\limits_{j=1}^{N} Q_j$ = $\sum\limits_{j=1}^{N}\sum\limits_{i=1}^{M} q_{ij}$ = Volume of USPS delivered mail

TQ = Volume of all USPS mail

QND = $TQ - QDM$ = Volume of USPS non-delivered mail

pqc_i = Percentage of shape i volume considered contestable (see Section A.1.3)

qc_{ij} = $pqc_i * q_{ij}$ = Contestable mail of shape i delivered on route j

QC_j = $\sum\limits_{i=1}^{M} qc_{ij}$ = Volume of contestable mail delivered on route j

        (QC_j is a subset of Q_j.)

$$TQC = \sum_{j=1}^{N} QC_j = \sum_{j=1}^{N}\sum_{i=1}^{M} qc_{ij} = \text{All contestable mail volume}$$

e_i = Price elasticity of demand for shape i

r_i = Delivery price of mail shape i

$$R_j = \sum_{i=1}^{M} r_i q_{ij} = \text{Delivery revenue from mail delivered on route } j$$

$$RD = \sum_{j=1}^{N} R_j = \sum_{j=1}^{N}\sum_{i=1}^{M} r_i q_{ij} = \text{Revenue from delivery activity (i.e., delivery revenue}$$
from delivered mail)

TR = Total USPS revenue

$RND = TR - RD$ = Revenue from non-delivery activities (i.e., upstream revenue from delivered mail and revenue from non-delivered mail)

mc_i = Unit delivery cost[24] of mail shape i

$vc_{ij} = mc_i * q_{ij}$ = Variable delivery cost of volume of shape i delivered on route j

$$VC_j = \sum_{i=1}^{M} vc_{ij} = \text{Volume variable cost of route } j$$

$$VC = \sum_{j=1}^{N} VC_j = \text{Total USPS variable delivery cost}$$

FC_j = Fixed cost of route j

$$FC = \sum_{j=1}^{N} FC_j = \text{Total USPS fixed costs of delivery activity}$$

$C_j = VC_j + FC_j$ = Total cost of route j

$$CD = \sum_{j=1}^{N} C_j = VC + FC = \text{USPS cost of delivery activity}$$

CND = USPS non-delivery variable costs (i.e., upstream variable cost)

TFC = Total USPS fixed costs

$FCR = TFC - FC$ = Residual USPS fixed costs (i.e., fixed costs not assigned to delivery)

$TC = CD + CND + FCR$ = Total USPS cost

$\Pi_j = R_j - C_j$ = Delivery profits from mail delivered on route j

$$\Pi D = \sum_{j=1}^{N} \Pi_j = RD - CD = \text{Profits from delivery activity (i.e., delivery profits from}$$
delivered mail)

$\Pi ND = RND - CND$ = USPS profits from non-delivery activities

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[24] All costs used in the model include the costs of direct and supervisory labor as well as vehicle and space-related costs.

$T\Pi$ = $\Pi D + \Pi ND - FCR$ = Total USPS profits

vcc_{ij} = $mc_i * qc_{ij}$ = Variable cost of contestable mail of shape i delivered on route j

VCC_j = $\displaystyle\sum_{i=1}^{M} vcc_{ij}$ = Variable *delivery* cost of contestable mail on route j (Does not include the upstream variable cost of contestable mail)

rc_{ij} = $r_i * qc_{ij}$ = Entrant's undiscounted revenue from contestable mail of shape i delivered on route j (i.e, USPS revenue from contestable mail of shape i delivered on route j)

RC_j = $\displaystyle\sum_{i=1}^{M} rc_{ij}$ = Entrant's undiscounted revenue from contestable mail delivered on route j (i.e, USPS revenue from contestable mail delivered on route j)

γ = Entrant's number of delivery days per week

δ = Entrant's discount of USPS prices

λ = Entrant's labor compensation factor

MU = Markup required to restore original delivery profit after mail skimming from USPS routes and volume losses due to price elasticity effect

A.1.3 Parameters

The model makes use of five parameters: pqc_i, the percentage of each shape i considered contestable; γ, the entrant's number of delivery days per week; δ, the discount from the incumbent's price offered by the entrant in order to attract new customers; and λ, the entrant's labor compensation factor in comparison to USPS. Table A-1 displays the values of pqc_i used to develop each level of contestable mail.

Table A-1: Percentage of Delivered Shape Volume Considered Contestable

Shape	Volume (000)	Percentage of Shape Volume Included in Each Measure of Contestable Volume					
		18 billion	36 billion	46 billion	78 billion	102 billion	122 billion
Letters	108,828,808	7.5%	14.9%	23.3%	39.7%	56.2%	71.3%
Flats	47,394,263	20.8%	41.6%	42.7%	73.2%	84.3%	92.1%
Parcels	2,077,498	1.0%	2.1%	16.0%	21.2%	32.2%	45.8%
		Contestable Volume as a Percentage of Bulk Delivered Volume					
		14.7%	29.4%	37.6%	64.2%	83.3%	100.0%

A.1.4 Formulas

Calculation of new volume q_{ij} of a shape $i(i = 1,2,3,...,M)$ delivered on route $j(j = 1,2,3,...,N)$ after a change in its price r_i

$$q_{ijA} = q_{ijB}\left(r_{iA}/r_{iB}\right)^{e_i}$$

Where A and B subscripts denote "After" and "Before" the change in price.

Calculation of new contestable volume qc_{ij} of a shape $i(i = 1,2,3,...,M)$ delivered on route $j(j = 1,2,3,...,N)$ after a change in its price r_i

$$qc_{ijA} = qc_{ijB}\left(r_{iA}/r_{iB}\right)^{e_i}$$

Where A and B subscripts denote "After" and "Before" the change in price.

A.1.5 Model Algorithm

The computational method or algorithm of the model involves a number of iterations. In each iteration $k(k = 1,2,3,...,O)$ a test is performed on each route $j(j = 1,2,3,...,N)$ to determine whether the entrant captures the contestable mail (QC_j) on the route.

Iteration 1:

For all routes that satisfy the inequality

$$\left(VCC_j + \left(\gamma/6 * FC_j\right)\right)* \lambda < RC_j *(1 - \delta)$$

set QC_j = 0 and calculate MU as follows:

$$MU_1 = \left(RD_0 - CD_0 + CD_1\right)/RD_1$$

where RD_0 = Initial USPS revenue from delivery activity;
     RD_1 = USPS revenue from delivery activity after the first skimming of routes and volume losses due to price elasticity effect;
     CD_0 = Initial USPS cost of delivery activity; and
     CD_1 = USPS cost of delivery activity after the first skimming of routes and volume losses due to price elasticity effect.

Iteration k:

For all routes that satisfy the inequality

$$\left(VCC_j + \left(\gamma/6 * FC_j\right)\right)* \lambda < RC_j *(1 - \delta)* MU_{k-1}$$

set QC_j = 0 and calculate MU as follows:

$$MU_k = \left(RD_0 - CD_0 + CD_k\right)/RD_k$$

Where RD_0 = Initial USPS revenue from delivery activity;
     RD_k = USPS revenue from delivery activity after the kth skimming of routes and volume losses due to price elasticity effect;
     CD_0 = Initial USPS cost of delivery activity; and

CD_k = USPS cost of delivery activity after the kth skimming of routes and volume losses due to price elasticity effect.

Iteration O (last iteration):

None of the routes satisfies the inequality

$$\left(VCC_j + \left(\gamma/6 * FC_j\right)\right) * \lambda < RC_j * (1 - \delta) * MU_{o-1}$$

and a new equilibrium is achieved.

A.1.6 Data

U.S. delivery data are from the USPS City Carrier Cost System and the Rural National Mail Count System (USPS-LR-I-448 and USPS-LR-I-474 2000). City carriers make up 72 percent of the routes and rural carriers make up the remainder.[25]

The City Carrier System contains a stratified sample of 8,300 routes and the 1999 Rural National Mail Count System provides data on 39,737 rural routes. These sources provide the subclass volumes delivered on each route. City carrier time is derived from the USPS Cost Segments and Components Report for FY 1999 and the average time is calculated and used for all city carrier routes. Rural carrier time is included in the rural mail count system.

To develop variable and fixed costs, we divide out-of-office delivery costs into activity components using the method developed by USPS (USPS-LR-I-404 2000). Load time is included in the variable costs. For simplicity the variable portion of access and travel to and from the beginning of the route are ignored. Variable costs on a route are estimated by multiplying route volume by average variable costs.[26] The remaining time is fixed and includes the time between stops (route time and the fixed portion of access) and the fixed portion of travel time.

In Table A-1 below, the initial unit prices for the delivery function are calculated to be 19.9 cents per letter, 22.2 cents per flat, and $1.49 per parcel.

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[25] Approximately 30 percent of rural routes serve non-rural urban suburbs.

[26] For a few high-volume routes, this results in variable costs that exceed the average total route cost. Average costs may not accurately reflect the cost characteristics of these routes.

Table A-1: Calculation of Delivery-only Prices by Shape
Used as Prices for Contestable Mail in Cream-Skimming Model

A. Unit Variable Cost for Delivery-only Letters and Flats

		Basic ECR	
		Letter	Flat
Test Year After Rates (TYAR) 1998 unit variable cost (cents)		7.1	9.2
FY 1998 Enhanced Carrier Route (ECR) unit cost (cents)	6.4		
FY 1999 Enhanced Carrier Route (ECR) unit cost (cents)	7.1		
FY99 / FY98 ratio	1.1		
Estimated FY 1999 unit variable cost (cents)		**7.8**	**10.2**

B. Unit Contribution to Fixed Cost for Delivery-only Letters and Flats

Fixed Delivery Cost ($ 000)	
Fixed City Delivery Cost	8,340,524
Fixed Rural Delivery Cost	2,744,027
Fixed Special Delivery Messenger Cost	48,705
Total Fixed Delivery Cost	**11,133,256**
Delivered Volume (000)	158,300,584
Unit Contribution for Delivery Overhead Paid by Delivered Mail (cents)	7.0
Other Fixed Cost ($ 000)	
Total Fixed Cost	22,309,993
Fixed Delievery Cost	(11,133,256)
Fixed Mail Processing Cost	(743,346)
Fixed Transportation Cost	(334,094)
Other Fixed Cost	**10,099,297**
Total Volume (000)	201,593,375
Unit Contribution for other Overhead Paid by All Mail (cents)	5.0
Total Unit Contribution Paid by Delivered Mail (cents)	**12.0**

C. Delivery-only Prices

	Letter	Flat	Parcel 1/
Delivery Prices (cents)	**19.9**	**22.2**	**149**

Note: Delivery and mail processing costs include the costs of direct and supervisory labor as well as vehicle and space-related costs.
Sources: Docket Nos. R97-1, R2000-1 and R2001-1, FY 1999 Billing Determinants and Cost Segments and Components Reports.
1/ Parcel delivery price is set at Test Year Parcel Select DDU average revenue from R2001-1 rate case.

A.2   Financial Model

The financial model spreads over time the entrant's growth in volume, revenue, and costs to calculate annual profits and losses and the IRR from the resulting cash flows. The calculations are performed in a series of Excel worksheets that reflect different parametric values for the input variables. The model for the base case is given in Table A-2. An interactive version of the model is given at www.prc.gov.

Table A-2: Summary of Annual Financial Results of Entrant
and Internal Rate of Return
(Base Scenario)

Percent of Final Fixed Costs		20%	40%	60%	80%	100%	100%	100%	100%	100%	100%
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Years 11+**
Letter Volume		179,133	533,990	1,207,311	2,386,413	4,187,744	6,437,039	8,632,973	10,317,837	11,387,090	12,605,959
Flat Volume		234,655	699,501	1,581,518	3,126,084	5,485,739	8,432,206	11,308,771	13,515,861	14,916,530	16,513,188
Parcel Volume		481	1,434	3,242	6,409	11,246	17,287	23,184	27,709	30,580	33,853
Total Volume		414,270	1,234,925	2,792,072	5,518,905	9,684,729	14,886,532	19,964,928	23,861,406	26,334,199	29,153,000
Markup factor		0.002	0.007	0.017	0.033	0.058	0.088	0.119	0.142	0.157	0.173
Letter Price		0.180	0.180	0.182	0.185	0.189	0.195	0.200	0.205	0.207	0.210
Flat Price		0.200	0.201	0.203	0.206	0.211	0.217	0.224	0.228	0.231	0.234
Parcel Price		1.344	1.351	1.363	1.385	1.418	1.460	1.500	1.531	1.551	1.573
Letter Revenue		32,162	96,340	219,818	441,429	793,205	1,254,897	1,729,671	2,110,048	2,358,695	2,649,000
Flat Revenue		47,000	140,786	321,232	645,083	1,159,153	1,833,847	2,527,659	3,083,523	3,446,884	3,871,123
Parcel Revenue		647	1,937	4,420	8,876	15,949	25,233	34,779	42,428	47,427	53,265
Total Revenue		79,808	239,063	545,470	1,095,388	1,968,307	3,113,977	4,292,109	5,235,999	5,853,006	6,573,388
Variable Route Costs		24,482	72,980	165,002	326,148	572,333	879,742	1,179,857	1,410,125	1,556,258	1,722,840
Fixed Route Costs		554,732	1,109,464	1,664,195	2,218,927	2,773,659	2,773,659	2,773,659	2,773,659	2,773,659	2,773,659
Total Route Costs		579,214	1,182,443	1,829,197	2,545,075	3,345,992	3,653,400	3,953,516	4,183,784	4,329,917	4,496,499
TOTAL Net Delivery Profit	**-**	**(499,406)**	**(943,380)**	**(1,283,726)**	**(1,449,687)**	**(1,377,685)**	**(539,423)**	**338,593**	**1,052,215**	**1,523,089**	**2,076,889**
Marketing and Other Overhead		131,468	262,936	394,403	525,871	657,339	657,339	657,339	657,339	657,339	657,339
Total Costs	177,670	710,681	1,445,379	2,223,600	3,070,946	4,003,331	4,310,739	4,610,855	4,841,123	4,987,256	5,153,837
Profit (Loss)	**(177,670)**	**(630,873)**	**(1,206,316)**	**(1,678,130)**	**(1,975,558)**	**(2,035,024)**	**(1,196,762)**	**(318,746)**	**394,876**	**865,750**	**1,419,551**
											Value of Perpetuity
Future Values	(177,670)	(630,873)	(1,206,316)	(1,678,130)	(1,975,558)	(2,035,024)	(1,196,762)	(318,746)	394,876	865,750	14,888,078
Internal Rate of Return (IRR)	**9.5%**										
PV	(162,204)	(525,821)	(917,919)	(1,165,781)	(1,252,936)	(1,178,301)	(632,619)	(153,825)	173,977	348,234	5,467,196
NPV	0										
NPV check	0										
Assumed Discount Rate	9.5%										

Note: Other scenarios available from the authors.

APPENDIX B: COMPARISON WITH PREVIOUS PAPER

The cream-skimming model presented in this paper is a revision of the model initially presented in Cohen et al. (2004). The most significant difference between the models is that the previous model uses content-based postal prices whereas the current one uses shape-based prices. This change, shown as items 2 and 3 in Table B-1, necessitates a structural change in the model. The original cream-skimming model assigns to each piece both a delivery cost and a nondelivery (upstream) cost using U.S. Postal Service upstream variable costs for the applicable content-based category. The incumbent is required to continue making the same

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**Table B-1: Differences between Cream-Skimming
Models Used in Graveyard Spiral Papers**

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	"An Empirical Analysis of the Graveyard Spiral"	**"Will Entrants into a Liberalized Delivery Market Attract Investors"**
1.	Five levels of contestable volume are analyzed: 36 billion, 46 billion, 78 billion, 102 billion, and 122 billion. Contestable mail levels defined using shares of subclass volumes.	Six levels of contestable volume are analyzed: 18 billion, 36 billion, 46 billion, 78 billion, 102 billion, and 122 billion. Contestable mail levels defined using shares of shape volumes.
2.	Volume variable costs/revenue for incumbent: – subclass-based variable delivery cost – subclass-based variable non-delivery cost (upstream cost) – subclass-based revenue (average revenue per piece)	Volume variable costs/revenue for incumbent: – shape-based variable delivery cost – no non-delivery cost (upstream revenue assumed to equal upstream costs) – shape-based delivery-only revenue
3.	Volume variable costs/revenue for entrant: – subclass-based variable delivery cost – no non-delivery or upstream cost – entrant's base revenue per piece assumed to be 12.6 cents (Postal Service's ECR price)	Volume variable costs/revenue for entrant: – shape-based variable delivery cost – no non-delivery or upstream cost – shape-based delivery-only revenue with base of 19.9 cents for letters, 22.2 cents for flats, and $1.49 for parcels.
4.	Fixed costs included from routes without volume (1 observation representing 9 routes affected).[a]	No fixed costs on routes without volume (1 observation representing 9 routes affected)
5.	Entrant offers no discount over Postal Service's ECR price.	Entrant offers discount of 5 to 15 percent over Postal Service's shape-based delivery prices.
6.	Entrant's cost relative to the incumbent is calculated using an efficiency factor ranging from 20% to 100%. The efficiency factor is applied to both fixed and variable costs.	Entrant's cost relative to the incumbent is calculated using a labor compensation factor ranging from 80% to 100%. The compensation factor is applied to both fixed and variable costs. Additionally a factor representing the number of delivery days is applied to fixed costs only. It ranges from 2/6 to 6/6.
7.	Incumbent's price increases are not capped.	Incumbent's price increases are capped at 200 percent of original prices.
[a]	In both models, the incumbent's fixed cost for each city route is based on the difference between an assumed total cost for the route type and the route's variable delivery cost. On routes where variable delivery cost exceeds the total route cost, fixed cost is set at zero.	

contribution to overhead and fixed delivery cost regardless of volume losses due to cream skimming. With the new shape-based model, it is no longer possible to assign per-piece nondelivery (upstream) costs by category. A letter might be a single item placed in a collection box or a part of a highly-workshared mailing. Therefore, the authors have made an assumption that for all products, upstream revenue exactly equals upstream variable cost. The incumbent must give the entrant access at a discount of 100 percent of avoided costs. As in the previous model, the current cream-skimming model requires the incumbent to keep the same amount of contribution to overhead and fixed delivery costs despite losing volume to the entrant. In the current case, however, the contribution is calculated solely from the difference between delivery revenue and delivery costs. Thus, contribution is a relatively larger share of revenue than in the previous model.

In addition to the shift to shape-based pricing and its structural effects, the current model contains other adjustments also shown in Table B-1. An additional parameter for the level of contestable volume is used, 18 million. Fixed costs from a few routes without volume are excluded. The current model calls for the entrant to skim contestable mail from a route if it can successfully make a profit offering a discount off the incumbent's shape-based delivery prices for the contestable pieces. In the previous model, the entrant takes the route if its average cost for delivering the contestable mail is less than the incumbent's single threshold of 12.6 cents, the Postal Service's ECR price. The method for comparing efficiency has also changed. Instead of the simple parameterized factor used to calculate the entrant's efficiency relative to the incumbent in the original model, there are two variables for introducing the entrant's efficiency: the number of delivery days for the entrant and the entrant's labor compensation factor. Additionally, a cap on price increases has been introduced to prevent increases more than 200 percent.

Figures B-1 through B-3 contrast the results of the current model to those of the previous one. To aid comparability, the efficiency factors from the previous model are used, the cap on price increases is lifted, no discount appears, and only the original five levels of contestable volume are shown. These adjustments should better highlight the impact of changing from content-based to shape-based pricing. Since the original model includes upstream costs and revenue, upstream costs and revenue have been added to the contribution results of the current model when calculating the price adjustment needed to retain the same profit level. These upstream costs and revenue do not appear in the calculations used elsewhere in this paper and have the effect of reducing the percentage of rate increase required. Two different increase paths are shown for Model 2 in Figure B-1. The top line is calculated using the average upstream revenue per piece, which by the assumptions of the current model equals the average upstream cost per piece. Each time a piece of volume is lost, both revenue and costs are reduced by this per-piece amount, leading to a price increase of 396.4 percent for the remaining delivery revenue at the upper level of contestable volume. This assumption, however, may be too extreme. It is far more likely that heavily workshared volume with little upstream cost and revenue will be skimmed first. Single-piece mail with high upstream costs will be the last to go. The second increase path, which assumes that total upstream cost and revenue do not change, provides the lower bound of an increase resulting from that possibility. In truth, the likely increase probably falls somewhere between the two paths. Neither assumption affects the actual amount of delivery revenue required by

the model to maintain the same level of contribution, just the percentage increase that that amount of revenue represents. With a smaller base, higher increases are required.

The effect of the change from content-based to shape-based pricing is to reduce the per piece profit of the single-piece mail retained by the incumbent under competition. This in turn forces the incumbent to have larger increases in postal prices to maintain breakeven status than are necessary in a content-based pricing system. This effect is exhibited in Figures B-1 through B-3.

At the benchmark contestable volume levels (37.6 percent of bulk mail), the impact is not that great (100.79 versus 109.8 percent). But as the volume of mail considered contestable increases, the estimates of price increases and cream-skimmed mail under the two models diverges significantly.

Even using the revised model for inputs to the financial model, the results indicate that the return on investment is low for nearly all scenarios examined. The ROI would be even lower using the original model as the source of inputs. Thus, the conclusions regarding the unattractiveness of investment opportunities for an entrant remain under both cream-skimming models.

Figure B-1: Model Comparison
Price Adjustment Needed to Maintain Same Profit Level
Assuming Entrant Cost Level is the Same as USPS
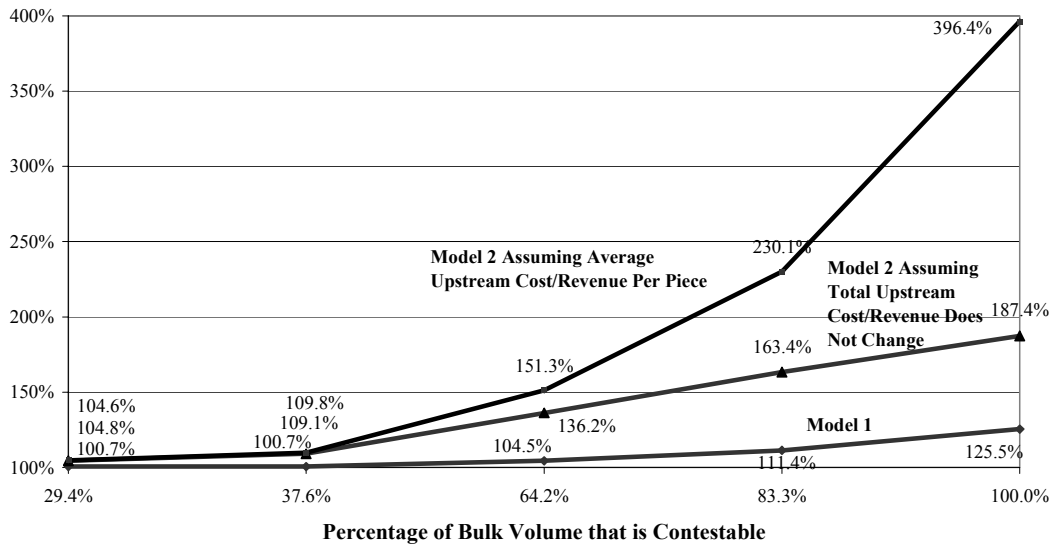
Figure B-2: Model Comparison
Volume Skimmed
Assuming Entrant Cost Level is the Same as USPS

Percentage of Bulk Volume that is Contestable
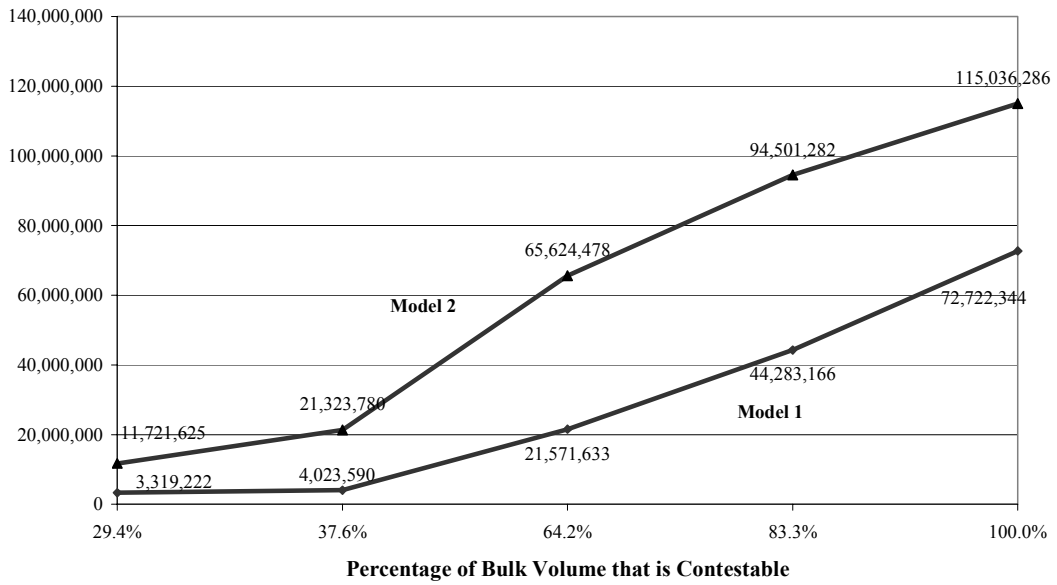
Figure B-3: Model Comparison
Skimmed Routes as a Percentage of Total Routes
Assuming Entrant Cost Level is the Same as USPS

Percentage of Bulk Volume that is Contestable
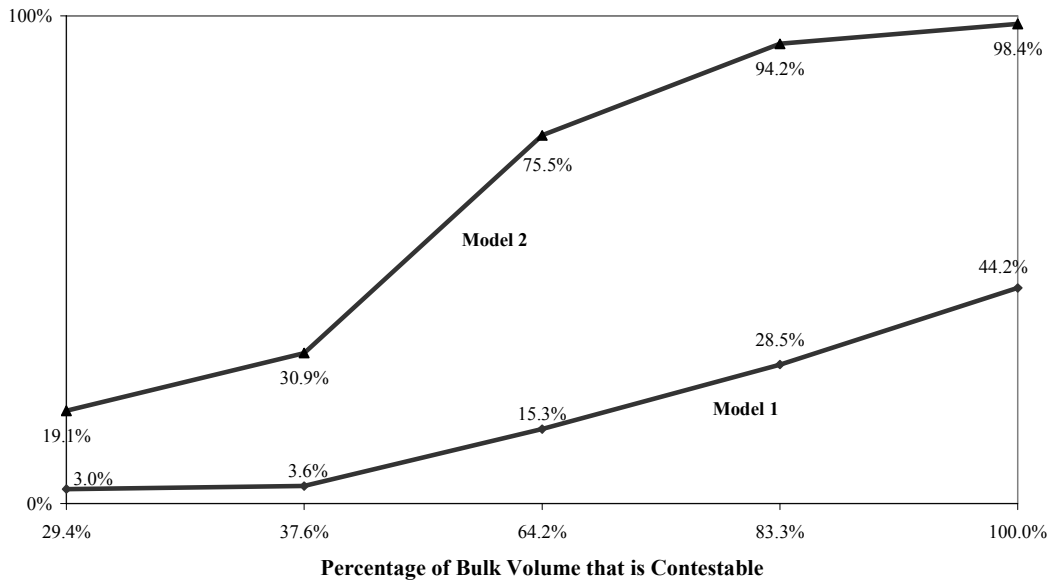
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