Limited Partnerships and Reputation Formation

Jarl G. Kallberg, Crocker H. Liu

Department of Finance

Stern School of Business, NYU

Anand Srinivasan

Department of Banking and Finance

Terry College of Business, University of Georgia

Revision November 22, 2002

Abstract

This paper analyzes the optimal quality decision of a producer in a multi-period setting with reputation effects. Using a unique database of returns on real estate limited partnerships (RELPs), we empirically examine alternative theoretical predictions of optimal producer strategy. In particular, we test whether the producers in our market invest in reputation building by initially selling high quality goods and then lowering quality. Using a variety of statistical tests, we find evidence for reputation building, both in the aggregate and for individual developers.

Associate Professors of Finance at the Stern School of Business and Assistant Professor of Finance at the University of Georgia. We thank Stephen Brown, John Clapp, Ned Elton, William Greene, Martin Gruber, George Hamilton, Spencer Jefferies, Chris Mayer, Joe Perez, Rangarajan Sundaram, Gregory Udell and seminar participants at the AFA and the University of Connecticut for helpful comments. We are especially grateful to Matt Spiegel for his discussion of an earlier draft of this paper at the AFA Meetings. We also wish to thank Richard Levine for research assistance with this project. Data for this project were acquired using a research grant from the Stern School of Business. Please address comments to the authors at the Leonard N. Stern School of Business, New York University, Kaufman Management Education Center, Suite 9-190, 44 West 4th Street, New York, NY 10012-1126, and Terry College of Business, Brooks Hall, University of Georgia, Athens GA, 30602-6253, or through email: jkallber@stern.nyu.edu, cliu@stern.nyu.edu and asriniva@terry.uga.edu, respectively.

Limited Partnerships and Reputation Formation

Abstract

This paper analyzes the optimal quality decision of a producer in a multi-period setting with reputation effects. Using a unique database of returns on real estate limited partnerships (RELPs), we empirically examine alternative theoretical predictions of optimal producer strategy. In particular, we test whether the producers in our market invest in reputation building by initially selling high quality goods and then lowering quality. Using a variety of statistical tests, we find evidence for reputation building, both in the aggregate and for individual developers.

1. Introduction

> *… economists have long considered "reputations" and brand names to be private devices which provide incentives that assure contract performance in the absence of any third-party enforcer. This private-contract enforcement mechanism relies upon the value to the firm of repeat sales to satisfied customers as a means of preventing nonperformance. However, it is possible that economic agents with well known brand names and reputation for honoring contracts may find it wealth maximizing to break such long-term exchange relationships and obtain a temporary increase in profit.*
>
> Klein and Leffler (1981)

Many interesting financial problems involve asymmetries of information between the seller and potential buyers of a good. In the seminal "lemons" paradigm of Ackerlof (1970), the fact that the seller has superior information about the quality of the assets being sold implies that the goods being sold would be of lower than average quality, eventually leading to market failure. However, the situation is less obvious if there are repeated sales, as the above quotation suggests. For example, producers may initially be compelled to produce a higher quality product than otherwise optimal in order to overcome this "lemons premium." The repeated game setting thus creates a tension between the incentives to exploit informational asymmetries and the value of establishing a reputation for quality. The optimality of various strategies depends on, *inter alia*, the speed of information dissemination and the gains to reputation building.

There are numerous models (briefly overviewed in the third section of this paper) that analyze this sequence of quality-setting decisions. This theory focuses on a producer that has the ability to change its quality[1] in each period of a multi-period, discrete-time (potentially infinite-period) model. However, these models have undergone relatively little empirical testing. Motivated by this gap in the literature, this study uses a unique database of returns on real estate limited partnerships (RELPs) to empirically investigate quality-setting strategies of the producer. We run two basic tests; first, we test whether producers choose to initially build a reputation for quality and then produce lower quality goods in subsequent periods. In

this case, we should observe a decreasing trend in the returns on the sequence of offerings of a given sponsor. Secondly, we test for mixing strategies, where the producer alternatively selects quality from either a high or a low quality regime. In this case we should be able to identify two statistically different distributions of the producer's observed quality.

The RELP market provides an ideal setting for evaluating predictions concerning quality/reputation strategies for several important reasons. Firstly, almost all empirical studies on the links between reputation and quality are based on inferences gained from experimental settings.[2] Secondly, RELPs are perhaps more amenable to testing the theoretical predictions of quality/reputation models than the few studies that use real data.[3] In particular, the RELPs in our study are established as "blind pools," that is, the funds for the partnership are raised prior to the developer actually purchasing any properties. This means that the developer (producer) has a great deal of flexibility in setting the quality level of the partnership. Absent significant reputation effects, there are thus incentives for the developer to take advantage of these information asymmetries. However, over time, as the cash flows from the properties are realized, the quality of the developer (and the RELP) is gradually revealed, albeit with some noise. In our analysis, we equate the "true quality" of a partnership with the adjusted holding period returns (i.e., returns relative to a RELP index and adjusted for year of origination) to the partnership unit holder. Finally, our data are extensive enough, in terms of observations of individual developers and of a given developer's offerings, to allow for reasonable statistical inferences.

We find that, consistent with the theoretical predictions of the reputation building hypothesis, the average quality decreasing with each successive partnership issued by a given sponsor. This result is valid in the aggregate as well as for the majority of the sponsors in our sample. We also find that some producers engage in mixing strategies, producing high quality in some periods and low quality in others. Although our results might be influenced by

---

[1]See Tirole (1988) for an overview of the economic literature on quality and reputation.

[2] Examples include articles dealing with learning and reputation in bargaining games (for example, Roth and Schoumaker (1984), Neelin, Sonnenschein and Spiegel (1985) and Binmore, Shaked and Sutton (1985)), tests of reputation and entry deterrence (such as Jung, Kagel and Levin (1985), who test the chain store game of Selden (1978)), and more general tests of reputation and learning (e.g., Bloomfield (1994)).

[3]The empirical studies of reputation effects that we are aware of using real data are: Slade (1992), who uses Kalman filtering to test for supergame pricing strategies in gasoline retailing; Zapan (1989), who tests for

survivorship or incubation bias (since poor sponsors are unlikely to be around long enough to produce many offerings) we find that this bias is not large enough to taint our general results.

The outline of the remainder of the paper is as follows. Section two provides an overview of the basic institutional setting. Section three describes the most relevant economic models, while Section four describes the data. Section five analyzes our results and Section 6 presents our conclusions. An appendix reviews the relevant empirical methodology.

2. Institutional environment

Real estate limited partnerships represent an important mechanism for individual investors to pool their resources to participate in real estate. In contrast to traditional securities, partnerships typically represent direct investment in businesses (such as real estate) and are not publicly traded. Moreover, partnerships are neither rated by a rating agency nor followed by Wall Street analysts. The general partner (GP) organizes and assumes responsibility for running the partnership. Partnerships are not required to publish the values of their assets and as such, calculating capital gains and market values accurately is difficult. Most public partnerships require a minimum investment of $1,000 to $5,000 and they are actively marketed to "small" investors. Typically, the partnership is structured as a blind pool wherein the general partner (the sponsor) has not bought any assets until the offering is completely sold. Legally, a partnership must have a finite life, which is usually set at 50 years or more, to allow the general partner flexibility in timing the sale of properties.

Market participants in the initial offerings are almost always small individual investors, while institutions dominate the secondary market. Secondary market trading in these RELPs is done at substantial discounts (an average of 45%) to appraised value. These points are elucidated in Barber (1996, p.490):

> *The relation between current yields, leverage and discounts supports an agency cost explanation for the observed discounts. Reputation is particularly critical in the market for limited*

---

predatory pricing behavior in cable television leasing; Gorton (1996), who analyzes reputation formation in 19th century bank note markets.

partnerships, which are traded in an unorganized secondary market and have been consistently plagued by negative coverage in the financial press.

The general partner usually has complete discretion on what properties to purchase. For example, the prospectus of First Capital Income Properties Series VII reads:

> *No specific properties have yet been identified for acquisition by the partnership as of the date of this prospectus, and the General Partners have complete discretion in investing the proceeds of this offering."*

We sampled over 50 prospectuses of different partnerships and different sponsors. Only one had information on a few properties that the general partner intended to purchase with the proceeds of the offering.

With regard to the sale of properties, the partnership agreement does not usually bind the general partner in any way. However, many of the prospectuses have statements on when the general partner intends to start selling the property. A typical example from a partnership sponsored by JMB Corporation reads:

> *The partnership intends to hold the real properties it acquires until such time as sale or other disposition appears to be advantageous from the viewpoint of the Partnership's investment objectives. In general, the Partnership intends to sell or refinance properties between the fifth and twelfth years after acquisition … However, the Corporate general partner will not be obligated to sell properties at any particular time.*

Most of the partnership agreements stated expected time of sale between the fifth and fifteenth years. From the supplemental information provided subsequent to the offering, it was determined the proceeds are invested, in most part, within two years of the offering.

Because of the informational asymmetries associated with this organizational form, RELPs are particularly susceptible to the agent (general partner or sponsor) choosing actions that are suboptimal from the principal's (limited partner or unit holder) perspective. This issue of conflicting incentives between the general and limited partners has been well documented. An example is Wolfson's (1991) empirical analysis of oil and gas tax shelter programs; he cites the following excerpt from a drilling prospectus:

Should a Partnership acquire or lease or participate in drilling or producing operations on a Prospect in proximity to that of the General Partner or its Affiliates, the results of such activity by the Partnership may gratuitously benefit the General Partner or its Affiliates ... [This may] result in profits to the general Partner or its Affiliates, and such profits will not be paid to the Partnerships.

In our setting, the flurry of investor lawsuits involving misdealing, fraud and deceptive sales practices against the brokerage houses selling these RELPs provide us with ex-post evidence of these incentive problems. These lawsuits have led the Securities and Exchange Commission to investigate whether Wall Street firms such as Dean Witter, Paine Webber, Merrill Lynch, Shearson and Prudential Securities, among others, misrepresented partnership risk and rewards.[4] These observations suggest that, in the primary market, general partners might take advantage of relatively uninformed buyers. In the secondary market, as more information on asset quality is revealed, we expect prices to reflect more rational levels. This allows us to reasonably accurately assess the underlying quality of the RELP over time in our empirical analysis. However, it should be noted that our tests cannot rule out other possible explanations for the evolution of the market. For example, it is plausible that, as the market for RELPs developed, investors became more familiar with the risk-return tradeoffs and thus the market risk premium for RELPs changed. We mitigate this bias by adjusting our measure of quality for year of RELP issuance, as is clarified in Section 4.

There has been relatively little research into limited partnerships, particularly real estate limited partnerships. Most studies focus on RELP performance. Rogers and Owers (1985) find that only investors in the highest marginal tax bracket earn an adequate after-tax return. Kapplin and Schwartz (1986) re-evaluate the performance characteristics of publicly offered RELPs using secondary market prices and find that the returns in Rogers and Owers (1985) are overstated.[5] Kapplin and Schwartz (1988) find that returns on pre-1981 RELPs are similar to institutional grade real estate, while more recent RELPs tend to under perform

---

[4]These Wall Street firms are not only the biggest marketers of partnerships but they also sponsor the partnerships. For example, Paine Webber sold about $2 billion in limited partnerships according to the *NY Times* (November 28, 1994), including the Paine Webber real estate partnership.

[5]The differential in the returns between the two studies is partly attributable to the sample size (Kapplin and Schwartz had a larger sample), the age of the partnerships (Kapplin and Schwartz had younger RELPs), the time period examined, and subjective classifications of the distinction between income-oriented and tax-oriented RELPs.

institutional properties. Kallberg and Liu (1995) relate recent RELP performance to characteristics of sponsors and underlying properties; they find that the sponsor is one of the most important determinants of RELP performance.

3. Economic modeling

The theoretical starting point for this type of modeling is the lemons model of Ackerlof (1970). In this model, informational asymmetries can result in market failure. This model has been extensively tested; see, for example, Rosenman and Wilson (1991) and Genosove (1993). A theoretical solution to this potential market failure is to embed the problem in a multi-period setting; the seller's motives to capitalize on its informational advantages are then mitigated by reputation effects.

Our empirical work can most easily be interpreted through Shapiro's (1983b) and Diamond's (1989) multi-period models of reputation formation although the literature on "experience goods" is also relevant.[6] The earlier quality setting model of Shapiro (1982, 1983a, 1983b)) assumes that the producer is a monopolist that sets quantity and quality at each point in time so as to maximize expected utility by solving for an equilibrium quality setting strategy. He shows (Theorem 4) that (under mild concavity assumptions) there exist steady-state quality and quantity levels. He also shows that for sufficiently high levels of reputation, it cannot pay to build up reputation continually. This eventual decline in quality is a testable hypothesis. Shapiro, less formally, also analyzes the possibility of mixing behavior.

The later model of Diamond (1989, 1991) using the Kreps-Wilson (1982) sequential equilibrium paradigm,[7] considers the possibility of gaming behavior among the producers and buyers. A key component in his model is the evolution of the producer's reputation. Diamond's model begins with a group of "observationally equivalent" borrowers. One group can invest only in a safe (single-period) project; another group can invest only in a risky, negative net present value project; a third group has access to both projects. All

[6]Experience goods are goods whose quality cannot be determined precisely in one period. The usual setting either involves the producer choosing the mean of the quality distribution or, alternatively, quality can only be observed with noise. In either case, typically some type of Bayesian updating is used to revise the estimates of the producer's quality in each period.

[7]An important offshoot of this literature, somewhat tangential to our focus, deals with the use of price and advertising as a signal of quality; see, for example, Milgrom and Roberts (1982).

projects last one period and lenders cannot observe project realizations. In the initial period, all borrowers are identical so that all are charged the same borrowing rate. However, in subsequent periods, potential lenders can observe whether or not the borrower defaulted. Diamond assumes that in each period a new set of lenders emerges knowing only the track record of potential borrowers.

The equilibrium concept is the sequential Nash equilibrium of Kreps and Wilson (1982). In this equilibrium, any borrower that defaults will subsequently be unable to borrow. This implies that the equilibrium interest rate will decline over time as the aggregate quality of remaining borrowers improves. This decline in interest rates provides an empirical test of reputation formation in the aggregate. This, and other aspects of Diamond's model, is tested in Gorton (1996), which examines the market for bank notes in the 19th century. Gorton finds statistically significant evidence for a reputation effect in note prices. In addition to inferences about the aggregate population, Diamond's model also has empirical predictions about the behavior of individual borrowers. One that will be tested in our model is the presence of mixed strategies in the equilibrium.[8]

While Diamond's model is about debt markets, it is a very powerful tool for modeling reputation effects.[9] In addition, many of the model's assumptions are reasonably credible in our empirical setting. Our sponsor's choice of assets to be placed in a blind pool corresponds well with Diamond's borrowers' selection of projects. Defaults would correspond to poor outcomes. Since the primary market for these RELPs is individual investors, the assumption of new lenders in each period is reasonably well met, as is the lenders' inability to use other characteristics to determine borrower quality.

While in most multi-period models of this type, optimal strategies tend, in equilibrium, to converge to pure strategies, there are additional reasons for considering mixed strategies in our context. Firstly, in finite-period problems with learning, mixed strategies can persist.[10] Secondly, when one agent has private information and follows a pure strategy, it can appear to other observers that the agent is following a mixed strategy. This point (often referred to

---

[8] The conditions for the existence of mixed strategies are given in Diamond's Lemma 11.

[9] While developed as a model for debt markets, Diamond (1989: p.829) notes that his model is also applicable to reputation formation in general.

as a purification theorem) is made in Harsanyi (1973) and developed in Milgrom and Weber (1985) and Kreps (1990).

Although the model setting that Shapiro employs differs from that of Diamond, both models yield similar implications. In particular, producers choose to initially build a reputation for quality and then produce lower quality goods in subsequent periods. If this proposition holds, then we should observe a decreasing trend in the returns on the sequence of offerings of a given sponsor. There is also a possibility that producers engage in mixing strategies. If this is the case, then we should observe two different quality distributions.

4. Experimental data and design

Data on secondary market prices, liquidations and cash distributions were obtained from Robert A. Stanger & Company beginning in January 1, 1990 and ending in December 31, 1995. The time period studied coincides with the advent of reported secondary market prices for RELPs. All partnerships studied are publicly registered and are blind pools. Sponsors with less than six RELPs were excluded from our individual sponsor statistical analysis since there would be insufficient time series data; this results in a sample of 253 RELPs although the larger sample of 308 is used in computing the benchmark returns. Excluded from all of the subsequent analysis are partnerships that did not trade or traded very infrequently. As such, the data are biased towards actively traded partnerships of relatively large sponsors.

Origination dates associated with the partnerships studied range from 1977 to 1989. The total dollar volume of RELPs outstanding versus the amount in our sample is depicted in Figure 1. Our data represent 55% of the total. The remaining 45% are mainly RELPs that did not trade in the secondary market, making it impossible to determine their rates of return. The annual fluctuation in total volumes is substantial and reflects the large number of issues in the early 80's and the subsequent liquidation of older RELPs. Although the earlier RELPs are likely to be liquidating a significant number of their properties over our price

---

[10] See Bloomfield (1994) for an example and corresponding experimental testing of a mixed strategy equilibrium.

observation window, we find that the amount of liquidation does not significantly affect returns.[11]

Returns used in the following analysis are holding period returns calculated over the 1990 through 1995 observation window. There is one excess (total-period) return associated with each RELP calculated as follows. Initially, the total raw return in each quarter is calculated for each RELP based on observed transaction prices and cash distributions (liquidations and dividends).[12] These raw returns are then modified by two factors. First, we compute the excess return by deducting the benchmark RELP return, which is an equally weighted average of all RELP returns available in the given quarter, from the raw return. Second, from this excess return, we make a further adjustment to account for trend or learning in our data. An OLS regression was run on average excess RELP returns versus dummy variables for the year of origination. These dummy variable coefficients are then used to adjust the excess RELP return for year of origination.[13] Thus, the quality of a given RELP is the raw holding period return adjusted for the benchmark return and year of origin. We call this figure the *adjusted* return. Henceforth, this adjusted return will be our empirical proxy for the "true quality" of the RELP. In the context of the Shapiro or Diamond models, it reflects the quality level chosen by the sponsor. This characterization corresponds to the experience goods setting, since the buyer cannot establish the true quality of the asset until a significant amount of time has passed.

We first test for trends in average quality. The tests are based on splitting the sequence of a developer's partnerships into halves and performing simple tests for mean and variance shifts between the two subsamples. In the subsequent analysis, for each developer, we will refer to the first half of its RELP issues as the first period and the second half of its RELP issues as the second period. Naturally these "time periods" will differ for each developer.

We perform further tests (Quandt (1958, 1960, 1972), Brown, Durbin, and Evans (1972) and Quandt and Ramsey (1978)) to see if developers change their quality regimes or

---

[11] A regression of return versus percentage of liquidation had an R^2 of less than 1 percent and an insignificant F-statistic.

[12] In less than 1% of the cases a simple linear interpolation of prices was used if there was a quarter without an observed price.

[13] An earlier version of this paper did not incorporate this trend correction. Those results are qualitatively nearly identical to those given below and are available from the authors upon request.

engage in mixing strategies. For example, the finding of a higher variance in the first period and a lower mean in the second, is consistent both with markets learning more about the appropriate risk premium for a given developer, and with a strategy of mixing from a distribution in the first period (in order to make it difficult to uncover quality in the first period) and then in the second period to milk its reputation (in the parlance of Shapiro) by producing lower quality goods. This strategy is, in a sense, a variant of the reputation building story, where the developer, instead of building a reputation, injects variance into its quality level. The details of these tests are described in the appendix. The tests are also performed on a pooled basis to test for overall reputation effects. A *t*- (*F*-) test is then computed to test if the mean (variance) in period 1 is higher than the mean in period 2.

5. Empirical results

Sample characteristics

Table 1 presents the general characteristics of our RELP sample. Panel A shows the total dividend payout by 1987 to 1989 as a percentage of initial capital. By the end of 1989, the average RELP had paid out 25.4% of its initial capital as dividends. The average leverage (total debt over total initial capital) in our sample is 27.3%. A measure of RELP quality, which we will use later in this section, is the rating given LPs by Partnership Profiles. It is a rating from 1 (the highest) to 5; separate ratings are given to financial condition and to cash distributions as of December 31, 1989; the respective averages for our sample are 1.69 and 3.35. Panel B of Table 1 shows these RELP characteristics by RELP issuance sequence. The cost basis of the RELPs rises significantly from the first issue ($53.1 million) to the tenth RELP issued by a sponsor ($111.9 million). The Partnership Profile ratings for both financial condition and cash distributions decline slightly, although neither trend is significant. The downward trend in raw returns is also evident. The average cost basis value of our RELPs is $85.5 million.

Table 2 shows the mean semi-annual returns over our 6-year observation window (January 1990 to December 1995) organized by offering number; the figures are unadjusted returns formed from data on cash distributions and secondary market prices. The in-sample group consists of the 253 offerings by developers with at least 6 RELPs in the sample; the

out-of-sample group consists of the 55 offerings by developers with 5 or less RELPs.[14] The most important feature is the trend of decreasing returns, which suggests an aggregate reputation effect. For the in-sample group, 6 of the first ten offerings have positive mean returns; 4 of offerings 11 through 20 have positive mean returns; none of offerings 21 through 30 have positive mean returns. Note that it is difficult to draw too much statistical inference at this point because the number of observations drops off rapidly after offering number 13.[15] Additionally, the data show no significant differences between the in-sample and out-of-sample average returns for offering number 1 through 5, suggesting that our results will not be overly influenced by survivorship or incubation bias. In the statistical analysis we will present detailed evidence of the reputation effect both on the aggregate level and for individual developers in our sample.

It is of interest to investigate the aggregate behavior of the RELP developers in our sample before focusing on individual developers. Figure 2 plots the adjusted return for each RELP ordered by issuance date. Thus, the x-axis value of i represents the adjusted return of the i^{th} RELP for each developer. The regression of adjusted returns versus offering number shows a significant negative coefficient on offering number and a significant positive constant.[16] This suggests that, even after censoring out developers with less than 6 RELPs, and after netting out aggregate market performance, the general quality of the RELPs declines with offering number. This indicates that, in the aggregate, developers in our sample engaged in reputation building. This result is a prediction of both the Shapiro model and the Diamond model.

The next series of statistical tests tries to identify which strategies individual developers may be following. Table 3 presents a test of mean and variance shifts. We find

---

[14] The latter group is omitted from our more detailed statistical analysis because we judged that 5 RELPs was too small a sample to permit inferences about trends in quality.

[15] For the in-sample data, only 3 observations were significant at the .10 level. These were significant negative returns for offering number 9, 11 and 12. None of the out-of-sample observations were significantly different from zero.

[16] This regression uses White's correction for heteroscedastic errors. It includes all sponsors (20) with 6 or more partnerships, yielding a total of 253 observations. The t-statistics are given in parentheses. The t-statistic on the slope coefficient is significant at the .003 level.

$$R = .0418 - .00487 \times \text{RELP number}$$
$$(1.947) \quad (-2.989)$$

that 4 of the 20 developers (Century, CNL, Krupp and Prudential) have significantly lower means (at the .05 level) in the second half of their offerings. The pooled data and 3 developers (Angeles, Insured and JMB) have significantly lower means at a significance level of .10. On the other hand, only Shurgard shows significantly higher returns in the second half of its offerings. Increasing returns are not predicted by any of the theoretical models. Although not a formal prediction of either Diamond's or Shapiro's model, Table 3 also suggests that the variance is decreasing over subsequent offerings. In particular, 3 of the developers have significantly lower variances (at the .05 level) in the second half of their offerings: Angeles, Krupp and Prudential. It is very interesting that each of these 3 also had significantly lower means in the first half of their offerings.

Testing for regime shifts

To simplify our exposition, we focus on developers that showed a significant decline in adjusted return in the second half of their offerings and that had more than 10 offerings in our data.[17] This leaves us with 5 developers: Angeles, Insured, JMB, Krupp and Prudential. For comparison, we also include aggregate results (when relevant) and results from the only developer, Shurgard, that had significantly higher quality in the second half of its offerings.

Testing for different quality regimes and mixed strategies is done in 3 stages. Initially we use the Quandt-Ramsey approach to test for mixtures of distributions. Secondly we compute the Quandt ratios for these 6 developers to provide an informal test. Finally, we use the Brown-Durbin-Evans (BDE) technique to test for the statistical significance of a possible regime shift. This analysis provides convincing evidence that some sponsors appear to exploit their informational advantages. To assist in the interpretation of these ratios, the adjusted returns are plotted in Figure 3. The appendix presents details on the statistical techniques used.

[17] The results for all developers are contained in a previous draft of this paper, which is available from the authors.

Table 4 reports the result of tests for mixtures of normals. [18] For the aggregate data, there is a 43% probability (λ) that returns are drawn from a distribution with a mean of 4.7% (μ_1) and a 57% probability (1-λ) that returns are drawn from a distribution with a mean of −3.6% (μ_2). This mean difference is significant at the .05 level, but the difference in standard deviations is not significant. Table 4 demonstrates that Angeles is primarily a low quality producer; the λ value indicates that there is a 91% probability that the mean adjusted return on an Angeles-issued RELP is −5.4% and a 9% probability that the return is 28.7%. Table 4 also shows significant evidence of mixing behavior for Krupp. There is a 30% chance that returns are drawn from a distribution with a high return (44.9%) and a high standard deviation (17.6%); there is a 70% chance that the distribution has a mean of −11.5 and a standard deviation of only 3.2%. The trend of returns in Figure 3 indicates that prior to the seventh RELP issued, Krupp was primarily a high quality producer

The Quandt likelihood ratio and the BDE cumulative sum of squares are plotted against issuance sequence in Figure 4. The Quandt technique identifies the regime break as the maximum of the plotted maximum likelihood ratio. The BDE technique signals a regime shift if the graph of the cumulative sum of squares moves outside the 10% confidence band (indicated by the dotted lines). The techniques in Figure 4 jointly suggest that two of the developers in this subsample may be switching quality regimes: JMB (offering 4) and Krupp (offering 6). Generally the techniques are in agreement although, because of the sensitivity of these techniques to the initial observations, they can disagree. For example, with Prudential (offering 7), the Quandt ratio suggests a regime shift, but the BDE test fails to detect this. For Angeles, Insured and Shurgard, the test fails to reject the hypothesis of constant quality. These RELP sponsors either consistently produced the same quality or there were more than two switches between regimes.

The Quandt ratio shows that the change in quality occurred near the issuance of the fifth RELP offering by Angeles, while the BDE graph reveals that this quality change is

---

[18] We do not report the R^2 statistic in Table 2 because in nonlinear estimation, the R^2 is not guaranteed to be in the range of zero to one. That said however, all of our R^2 were in the range of 98%-100%. In lieu of the R^2 statistic, we report $\sigma^2 = \frac{1}{n}\left[y_i - h(x_i, b)\right]^2$, which is the maximum likelihood estimator.

insignificant at the 10% level. From Figure 3, it appears as if the fifth RELP issued was the only offering (with the possible exception of the third) that performed reasonably well, that is, was of "good" quality. The profile of the returns on Prudential-sponsored RELPs resembles that of Angeles in terms of the λ, μ_1 and μ_2 in Table 4. Figure 3 also shows some evidence that Prudential engaged in reputation building, since the trend in adjusted returns associated with sequential RELP offerings is generally positive and increasing until the seventh RELP offering, where the Quandt ratio indicates that a possible change in quality occurred. This change in quality is significant according to the BDE graph. As for Angeles, Table 4 shows that the means are statistically different. For Krupp, the returns from the first to the third RELP are increasing and suggest reputation building. Subsequent to the sixth offering, where the Quandt ratio in Figure 4 reveals that a shift in quality occurred, Krupp was a consistently low quality producer. This shift from high quality to low quality is also evidenced by noting that $\mu_1 > \mu_2$ and $\sigma_1 > \sigma_2$ from Table 3. As with Angeles and Prudential, this evidence is consistent with a reputation effect.

Ex ante sponsor characteristics

Since these experiments suggest that certain developers in our sample have declining adjusted returns in their sequence of offerings, it is then interesting to investigate whether or not, ex ante, there are certain characteristics of the developer that affect this pattern of returns. This analysis is motivated by and related to the extensive literature dealing with equity offerings,[19] specifically, the literature dealing with longer-term performance and the underwriting certification hypothesis.[20]

We initially investigate the relationship between sponsor characteristics and realized performance by analyzing the correlations between a set of developer characteristics[21] and quality. The correlations are presented in Table 5. None of the correlations of sponsor characteristics versus quality are greater than .37 in absolute value. The negative correlations, although insignificant at the .01 level, correspond to characteristics that relate to increasing size of the sponsor: number of offerings, a dummy variable for sponsors that are publicly

[19] Our primary focus is not on issues relating to IPO underpricing since our assessment of quality is based on longer-term performance.

[20] See, for example, Beatty and Ritter (1986) on the former issue, and Booth and Smith (1986) on the latter.

[21] See Table 5 for definitions.

traded, number of developer SICs and total offering size. This suggests that the "lemons premium" is smaller for larger sponsors, presumably because of their greater initial reputation. To augment these correlations, a logistic regression (not shown) was performed with the dependent variable differentiating developers with a significant decrease in means in the second half of their offerings (cf. Table 2) from the remaining developers. Using a step-wise logistic approach, none of the sponsor variables were significant. This may be a further indication of the lack of transparency in this market. Even though these developers have observable ex ante characteristics that should lead investors to distinguish among them, apparently these differences have little influence on returns.

Survival bias

There are a number of competing hypotheses to explain the declining trend in abnormal returns. The most appealing alternative explanation is learning, either by the market or by the developer. In the first case, the uncertainty of the quality of the sponsor's offering declines as investors observe the performance of the earlier RELPs. In the second case, the developer acquires more skill in asset selection, financing, management or otherwise; this increasing skill leads to higher quality RELPs over time. Our data are also, in general, consistent with this interpretation.

There is another important factor that influences our empirical findings. Brown, Goetzmann and Ross (1995), henceforth BGR, show that survival bias can lead to the finding of decreasing returns over time (as in the Diamond and Shapiro model) as well as decreasing variance over time. This survivorship bias has two possible effects on our analysis. Firstly, our statistical tests are run with only those developers that have issued six or more partnerships. Secondly, and perhaps more importantly, survival bias affects even those developers that were included in our sample. As pointed out by BGR, we would expect that developers of lower quality would have a higher probability of being censored out of our sample. Thus, the negative trend in returns, rather than being an outcome of a conscious attempt by the developer to build up a reputation, could merely result from the fact that surviving developers had "lucky" outcomes in their initial partnerships. Similarly, high variance developers would have a greater probability of being censored out of our data.

We address the first potential problem by comparing the mean (unadjusted) returns on sponsors with less than six partnerships (the out-of-sample group), with those included in

our sample. We further restrict the out-of-sample group by deleting the sponsors that issued RELPs after 1990, which would not have been included in our sample. Although the out-of-sample group has a slightly higher mean return, a simple t-test indicates that the means are insignificantly different from each other. [22] To address the second survival bias effect, we regress the excess returns of the partnerships on a series of dummy variables for the year in which the partnership was formed. There is no apparent pattern in the dummy variables. A survival explanation would imply that partnerships formed earlier should have higher returns. Nevertheless, to account for possible year-specific effects, we conduct the above statistical tests on the returns adjusted for these dummy variable effects.[23] These year-specific factors capture more than survival bias, such as the performance of the overall real estate market. In summary, it is likely that survival effects have a significant influence on our results. The above tests suggest, however, that the magnitude of these effects is not so large as to invalidate our inferences.

Alternative measures of quality

We also performed robustness checks to ensure that our proxy for quality, adjusted return over the period 1990 to 1995, is reasonable. One measure of quality is the total dividends received until 1990. Table 6 shows an OLS regression (with White's correction for heteroscedasticity) using cumulative dividends as the dependent variable. The table shows that in both of the regressions, partnership sequence number has a significantly negative affect. This is consistent with our finding that issuance number has a significant negative affect on adjusted return.[24]

---

[22] The mean in-sample return is 12.4% versus 13.5% for the out-of-sample developers; the corresponding t-statistic is −.47, which is insignificant at all conventional levels. The means test with all of the out-of-sample partnerships generates almost precisely the same result.

[23] This regression run was abnormal return on year dummies. The results were abnormal return = -.0035 dum_{77} -.0754 dum_{78} -.0517 dum_{79} +.034 dum_{80} + .1309 dum_{81} +.0067 dum_{82} +.0823 dum_{83} -.0151 dum_{84} + .0018 dum_{85} +.0763 dum_{86} -.0383 dum_{87} -.0254 dum_{88} -.0769 dum_{89} , Adj R^2 = 4.56%, p-value = .034.

[24] A second alternative measure of quality was tested: the Partnership Profile financial condition rating at the end of 1989. This rating embodies both quantitative and qualitative aspects of the RELP. We performed an ordered probit analysis (not shown here) to predict this rating. While the overall fit was significant, none of the key characteristics (partnership issuance number, operating margin, leverage, age and size) were.

Ex post analysis

One explanation for our findings is that a number of developers exploited the informational asymmetries in this market. Informal evidence for this comes from a variety of popular press articles. In particular, Prudential Securities, in the fall of 1993, agreed to pay $371 million to settle complaints about its sales activity and promised returns in oil and gas and real estate limited partnerships. Prudential Securities, in an agreement with the Justice Department, admitted to fraud in selling $8 billion of limited partnership units. Our statistical analysis suggests that the returns on Angeles-sponsored RELPs appear to be drawn from two regimes with the mean return being significantly lower in the second half of its offerings. In a news story that appears to support this conclusion,[25] a reporter wrote that this:

> *West Los Angeles-based company has had an extraordinarily rich history as an incubator of some of the greatest investment stars -- and some of the biggest flops -- of the modern era … How the 60 year old Elliott (CEO) and his crew avoided the corporate gallows for so long is a classic tale of management making promises it couldn't keep, to investors who didn't know better.*

Angeles survived several financial crises, including a crash in the ski-resort condo market, by focusing on "cash flow" rather than real earnings until the cash flows on properties became nonexistent. The crises that finished Angeles involved investing in outlet malls and congregate care apartments; both were high-risk ventures involving heavy cash infusions.

In addition, two of the developers in our sample have gone bankrupt (Integrated Resources and Angeles Corporation) and most of the sponsors have changed organizational form to convert their RELPs into either real estate investment trusts (REITs) or master limited partnerships (MLPs). Shurgard appears to be the only high quality producer on a relative basis. Published reports[26] on Shurgard seem to support this view.

---

[25] Tom Petruno, May 7, 1993, "Broken promises finally clip the wings of Angeles and its investors," *Los Angeles Times*.

[26]Tim Urbonya, February 28, 1988, "Self-Storage: Success Breeds Change", *New York Times*, Section 8, Page 1, Column 1. Karen Milburn, July 2, 1990, "Shurgard and Limited Partners Spawn over 200 Storage Sites", *Puget Sound Business Journal* 11: pg 19A. Ken Berzof, March 19, 1989, "Investment Patience May Pay Off," *The*

6. Conclusions

This study empirically investigates the dynamics of quality setting and reputation using a unique database of returns on a series of real estate limited partnerships by the same developer. By examining the time series of a given developer's performance, we obtain important insights into the developer's strategy in determining its optimal tradeoff between reputation and short-term profits. We also obtain some understanding of the extent to which investors and RELP developers behave in this informationally opaque market.

We find that, as predicted by the Diamond and Shapiro models, in the aggregate, the average return declines with offering number. This result could be interpreted as showing that several sponsors, such as Angeles, Krupp and Prudential, appear to exploit the opportunities created by informational inefficiencies. This is evidenced by the returns on a sequence of RELPs issued being initially positive followed by negative returns on subsequent offerings. We also find significant evidence that these three developers also engage in mixed strategies, shifting between quality regimes, perhaps in an effort to make detection of their true quality more difficult. Furthermore, our empirical results correspond with known ex post facts, in particular the negative reports on Krupp and Prudential and the positive reports on Shurgard.

Courier-Journal. Jeanne Sather, June 19, 1992, "Commercial Storage Now More of Shurgard Factor," *Puget Sound Business Journal 1*3(6): pg 32. More specifically, news reports indicate that Shurgard has a historical annual average return on investment of around 15% (not market adjusted). Shurgard builds and manages over 200 mini-storage warehouses. Shurgard forms limited partnerships to provide all of the financing for the real estate deal with no reliance on debt.

Appendix: Empirical methodology

This appendix briefly overviews our empirical approaches. Evidence that a developer is using a mixing strategy is evaluated using the switching regression model of Quandt (1958, 1960, 1972).[27,28] This model assumes the existence of two regression regimes with a single unknown switch point between the two regimes. If there are T observations; the first t observations (sequential offerings of RELPs) are assumed to come from a regime with a given quality level, while the last $T - t$ observations represent RELP offerings from a different quality regime. The null hypothesis that sponsors do not change the level of quality in their RELP offerings is tested against the alternative proposition that a single change in quality occurs. The problem is to estimate the time, if any, at which the sponsor switches from one quality regime to another. We model the two different quality regimes as follows:

$$R = \alpha_1 + \beta_1 t + \varepsilon_1 \tag{1}$$

$$R = \alpha_2 + \beta_2 t + \varepsilon_2 \tag{2}$$

where R is the adjusted holding period return on the t^{th} RELP issued by a particular sponsor, and ε_1 and ε_2 are independent, normally distributed error terms with mean zero and standard deviations σ_1 and σ_2 respectively. This modeling of the quality regimes is motivated by the prediction of the Shapiro and Diamond models concerning the declining trend in quality.

The estimated location of the unknown (single) switch point t involves choosing as the maximum likelihood estimate the value of t that maximizes

$$\lambda(t) = -T\log\sqrt{2\pi} - t\log\hat{\sigma}_1 - (T - t)\log\hat{\sigma}_2 - \frac{T}{2} \tag{3}$$

More specifically, the procedure entails first ordering our RELPs in issuance date sequence. Separate regressions are then estimated for each of these groups. Next, the point of division between the two groups is moved by one time unit and a new set of regressions is estimated.

---

[27] Brown and Goetzmann (1998) use switching regressions to analyze mutual fund styles.

[28] All of the mixed strategy tests were performed only for those developers for which we had data on at least 11 partnerships. Eleven of the twenty sponsors qualified under this criterion. The value of this cutoff level is somewhat arbitrary. However, reliable estimation of mixed strategies requires a greater number of observations than simple mean or variance tests.

This process is repeated for all possible division points. There is no unbiased test statistic associated with this maximum likelihood procedure, especially in small samples (as in the present case) given contamination effects associated with the switch point.[29] As such, even though a particular plot may suggest that a switch has occurred, this point may not be statistically significant.

To overcome this deficiency in Quandt's likelihood ratio (LR) test, Brown, Durbin and Evans (BDE) proposed a test of nonstationarity that can be used with the LR test to determine if a given switch point is significant.[30] In this approach, the recursive residuals, w_t, are computed as follows

$$w_t \equiv \frac{Y_t - \hat{\alpha}_{t-1} - \hat{\beta}_{t-1} x_t}{\sqrt{1 + \frac{1}{t-1} + \frac{(x_t - \bar{x}_{t-1})^2}{\sum_{i=1}^{t-1} (x_i - \bar{x}_{t-1})^2}}} \tag{4}$$

Here $\hat{\alpha}_{t-1}, \hat{\beta}_{t-1}$ and $\bar{x}_{t-1}$ are the least squares estimators and the sample mean based on the first $t - 1$ observations. If the null hypothesis of a constant α and β is true, these residuals are independent standard normals. By plotting the cumulative sum of squares, s_t, defined as

$$s_t \equiv \frac{\sum_{j=1}^{t} w_j^2}{\sum_{j=t+1}^{T} w_j^2} \tag{5}$$

against time (number of offerings), we can reject the null hypothesis if the graph of s_t crosses the significance line. Thus, if the switch indicated by the BDE is close to the peak of the likelihood ratio, then we can conclude that there exist two distinct regression regimes. However, the BDE test could indicate nonstationarity without the LR showing any distinct peak. In this case, we would conclude that the quality changed gradually over time.

---

[29] Contamination is associated with the interval around the dividing point between the two groups of observations, t and $T - t$ observations. In essence, one doesn't know which regime the data are associated with.

[30] See Mehta and Beranek (1982) for an application to detecting changes in beta.

Both Quandt's LR and the BDE test assume that there is a single change in regression regimes. However, this need not always be the case. To address this problem, Quandt and Ramsey (QR) (1978) propose another test for the existence of two regression regimes. They assume that at each point in time, nature (in our case, the developer) picks one regime with probability λ and the other regime with probability $1 - \lambda$.

The QR model assumes that the probability density function associated with the RELP quality for a given sponsor represents a mixture of (at most) two normal densities. The null hypothesis, that sponsors do not change the level of quality in their RELP offerings, is tested against the alternative proposition that two quality regimes exists. Formally, we model the two different levels of quality as:

$$\begin{aligned} R_{Bt} &\sim N(\mu_1, \sigma_1^2) \;\; \textit{with probability } \lambda \\ R_{Bt} &\sim N(\mu_2, \sigma_2^2) \;\; \textit{with probability } (1 - \lambda) \end{aligned} \tag{6}$$

where the parameters λ, μ_1, μ_2, σ_1^2 and σ_2^2 are unknown. The two distributions of returns represent two different modes of sponsor behavior with λ measuring the probability that a sponsor chooses the first quality level. A disadvantage of this method is that it cannot identify which points belong to a particular regime. However, in this study, we are mainly interested in the existence of two regimes and identification of the regime to which an observation belongs is less important.

To estimate the mixture of normal distributions and λ, the moment generating function (mgf), $E(e^{\theta y})$, is minimized using weighted nonlinear least squares with the number (q) of values of θ set equal to fifteen to ensure that the corresponding normal equations are of full rank:[31]

$$\left(\sum_{i=1}^{n} \frac{e^{\theta_j y_i}}{n} \right) = \lambda e^{\mu_1 \theta_j + \sigma_1^2 \theta_j^2 / 2} + (1 - \lambda) e^{\mu_2 \theta_j + \sigma_2^2 \theta_j^2 / 2} \qquad j = 1, 2, ..., 15 \tag{7}$$

Since θ's determine the weights for the moments of the data by the mgf estimator, relatively small θ's were chosen (to the extent possible) so that low-order moments receive more

[31] This approach can be generalized to switching regressions. For further details, see Quandt and Ramsey (1978).

weight.[32] The Davidon-Fletcher-Powell algorithm is used to minimize the mgf. The parameters are estimated using nonlinear weighted least squares where the weights are the reciprocal of the disturbance variance.

Quandt and Ramsey (1978) argue that the preceding mgf has several advantages over using a maximum likelihood (MLE) function.[33] Most importantly, the mgf can be used with relatively small samples having considerable overlap in the two populations and the parameters obtained are unique estimates. The mgf method also yields consistent and asymptotically normal estimates. The asymptotic distribution of the mgf is independent of the θ parameters. In conjunction with the estimation of the mixture of normals, we use a Wald statistic to determine if the two normal distributions are identical (H_o: $\mu_1 = \mu_2$ and $\sigma_1^2 = \sigma_2^2$).

[32] While Quandt and Ramsey (1978) note that the choice of θ is important when $q = 5$, Schmidt (1982) has found that all reasonable choices of θ lead to the same asymptotic covariance matrix when $q = 15$ and that this matrix represents the lower bounds for the asymptotic variances. This is further justification for our use of $q = 15$.

[33] Known difficulties with the MLE method include the fact that the estimate may not be obtainable due to the unboundedness of the likelihood function. The possibility of a singular matrix of second partials of the log-likelihood function might also exist when unequal variances are allowed in the components of the mixture. In addition, the finite sample properties of the resulting estimates are unknown.

References

Akerlof, G. A., 1970, "The Market for Lemons: Qualitative Uncertainty and the Market Mechanism," *Quarterly Journal of Economics* 84: 488-500.

Barber, B., 1996, "Forecasting the Discounts of Market Prices from Appraised Values for real Estate Limited Partnerships," *Real Estate Economics*, 24, 4, 471-492.

Beatty, R.P., and J. R. Ritter, 1986, "Investment Banking, Reputation, and the Underpricing of Initial Public Offerings," *Journal of Financial Economics* 15: 213-232.

Binmore, K., A. Shaked, and J. Sutton, 1985, "Testing Noncooperative Bargaining Theory: A Preliminary Study," *American Economic Review* 75: 1178-80.

Bloomfield, Robert, 1994, "Learning a Mixed Strategy Equilibrium in the Laboratory," *Journal of Economic Behavior and Organization* 25: 411-436.

Booth, J.R., and R. L. Smith Jr., 1986, "Capital Raising, Underwriting and the Certification Hypothesis," *Journal of Financial Economics* 15: 261-281.

Brown, S. J., W. N. Goetzmann and S. Ross, 1995, "Survival," *Journal of Finance*, 50: 853-873.

Brown, S. J. and W. N. Goetzmann, 1998, "Mutual Fund Styles," *Journal of Financial Studies*, forthcoming.

Diamond, Douglas W., 1989, "Reputation Acquisition in Debt Markets," *Journal of Political Economy*: 97:4: 828-862.

Diamond, Douglas W., 1991, "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt," *Journal of Political Economy*: 99:4: 689-721.

Genesove, D., 1993, "Adverse Selection in the Wholesale Used Car Market," *Journal of Political Economy* 101: 644-665.

Gorton, Gary, 1996, "Reputation Formation in Early Bank Note Markets," *Journal of Political Economy* 104: 21: 346-397.

Harsanyi, John, 1973, "Games with randomly-distributed payoffs: A new rationale for mixed-strategy equilibrium points," *International Journal of Game Theory*, 2: 1-23.

Jung, Yu Joo, John H. Kagel, and Dan Levin, 1994, "On the Existence of Predatory Pricing: An Experimental Study of Reputation and Entry Deterrence in the Chain-Store Game," *Rand Journal of Economics* 25(1): 72-93.

Kallberg, Jarl and Crocker Liu, 1995, "Risk and Return in RELPs," in Altman and Vanderhoof, eds., *Surviving the Crisis in Retirement Systems*, Irwin, Homewood, IL.

Kapplin, Steven and Arthur Schwartz, Jr., 1986, "An Analysis of Recent Rates of Return and of the Secondary Market for Public Real Estate Limited Partnerships," *Journal of Real Estate Research*, 1: 33-44.

Kapplin, Steven and Arthur Schwartz, Jr., 1988, "Public Real Estate Limited Partnership Returns: A Preliminary Comparison with Other Investments," *AREUEA Journal*, 16: 63-68.

Klein, B., and K. Leffler, 1981, "The role of market forces in assuring contractual performance," *Journal of Political Economy* 89: 615-641.

Kreps, David M., 1990, *Game Theory and Economic Modeling*, Oxford Press, New York.

Kreps, David M. and Robert Wilson, 1982, "Sequential Equilibria," *Econometrica* 50: 863-894.

Mehta, C. R. and W. Beranek, 1982, "Tracking Asset Volatility by Means of a Bayesian Switching Regression," *Journal of Financial and Quantitative Analysis*: 17:241-263.

Milgrom, P. and John Roberts, 1982, "Predation, Reputation, and Entry Deterrence," *Journal of Economic Theory* 27: 280-34.

Milgrom, P. and John Roberts, 1986, "Price and Advertising Signals of Product Quality," *Journal of Political Economy* 94(4): 796-821.

Milgrom, P. and Robert Weber, 1982, "A Theory of Auctions and Competitive Bidding, " *Econometrica* 50(5): 1089-1122.

Milgrom, P. and Robert Weber, 1985, "Distributional strategies for games with incomplete information," *Mathematics of Operations Research* 10: 619-632.

Neelin, Janet, Hugo Sonnenschein, and Matthew Spiegel, 1988, "A Further Test of Noncooperative Bargaining Theory: Comment," *American Economic Review* 78: 824-836.

Quandt, Richard E., 1958, "The Estimation of the Parameters of a Linear Regression System Obeying Two Separate Regimes." *Journal of the American Statistical Association* 53: 873-880.

Quandt, Richard E., 1960, "Tests of the Hypothesis that a Linear Regression System Obeys Two Separate Regimes." *Journal of the American Statistical Association* 55: 324-330.

Quandt, Richard E., 1972, "A New Approach to Estimating Switching Regressions." *Journal of the American Statistical Association* 67: 306-310.

Quandt, Richard E. and James B. Ramsey, 1978, "Estimating Mixtures of Normal Distributors and Switching Regressions", with discussion, *Journal of the American Statistical Association*, 73: 730-752.

Rogers, Ronald and James Owers, 1985, "The Investment Performance of Real Estate Limited Partnerships," *AREUEA Journal*, 13: 153-166.

Roth, Alvin and Francoise Schoumaker, 1984, "Expectations and Reputations in Bargaining: An Experimental Study," *American Economic Review* 73(3): 362-372.

Schmidt, Peter, 1982, An Improved Version of the Quandt-Ramsey MGF Estimator for Mixtures of Normal Distributions and Switching Regressions, *Econometrica* 50: 501-516.

Selden, Larry, 1978, "A New Representation of Preferences over Certain And Uncertain Consumption Pairs: The Ordinal Certainty Equivalent Hypothesis," *Econometrica* 46: 1045-1060.

Shapiro, Carl, 1982, "Consumer information, product quality, and seller reputation," *Bell Journal of Economics*, 13(1): 20-35.

Shapiro, Carl, 1983a, "Premiums for High Quality Products as Returns to Reputations," *Quarterly Journal of Economics* 98: 659-679.

Shapiro, Carl, 1983b, "Optimal Pricing of Experience Goods," *Bell Journal of Economics* 14(2): 497-507.

Slade, Margaret, 1992, "Vancouver's Gasoline-Price Wars: An Empirical Exercise in Uncovering Supergame Strategies," *Review of Economic Studies* 59: 257-276.

Stanger, Robert and Keith Allaire, 1986, *How to Evaluate Real Estate Partnerships*, Robert A. Stanger and Company, Shrewsbury, New Jersey.

Tirole, Jean, 1988, *The Theory of Industrial Organization*, Cambridge, MA: MIT Press

Wolfson, Mark A., 1991, "Empirical Evidence of Incentive Problems and Their Mitigation in Oil and Gas Tax Shelter Programs," in *Principals and Agents: The Structure of Business*, Editors J. W. Pratt and R. Zeckhauser, Harvard Business School Press, Boston.

Zupan, Mark A., 1989, "Cable Franchise Renewals: Do Incumbent Firms Behave Opportunistically?" *Rand Journal of Economics* 20(4): 473-482.

Figure 1: Total Real Estate Limited Partnership (RELP) Volume

This figure depicts the total RELP volume (in $millions) over our sample period. It shows that our sample contains approximately 55% of the total dollar volume.

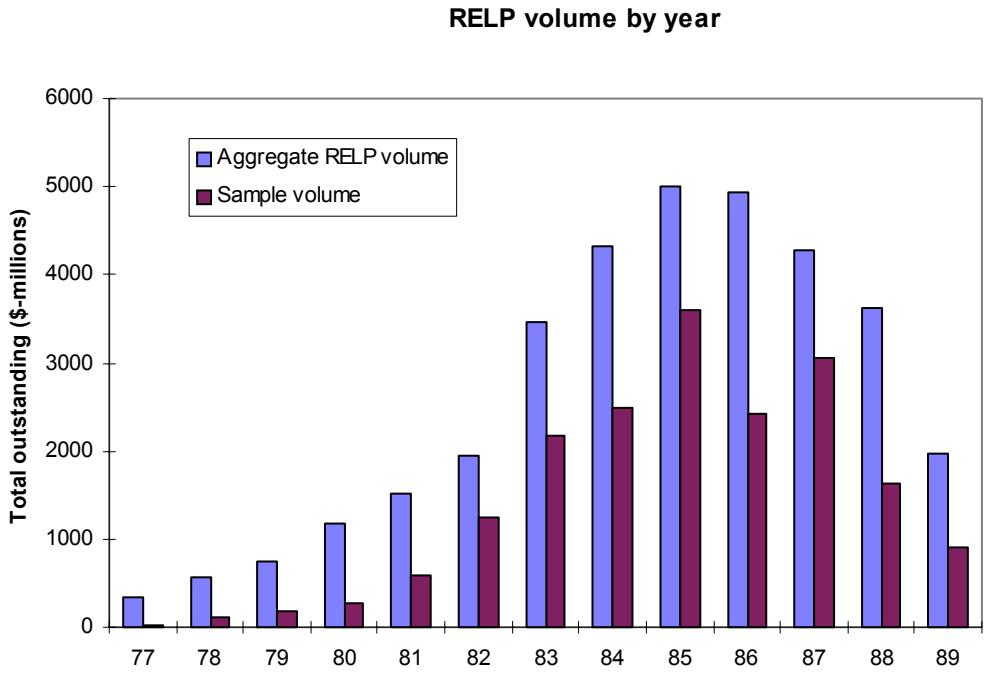


Figure 2: Returns of Various Sponsors Sorted by Order of RELP Issuance

This figure plots the adjusted returns for each RELP in its issuance order. The fitted regression line shows the negative trend in the returns. This regression uses White's correction for heteroscedastic errors.

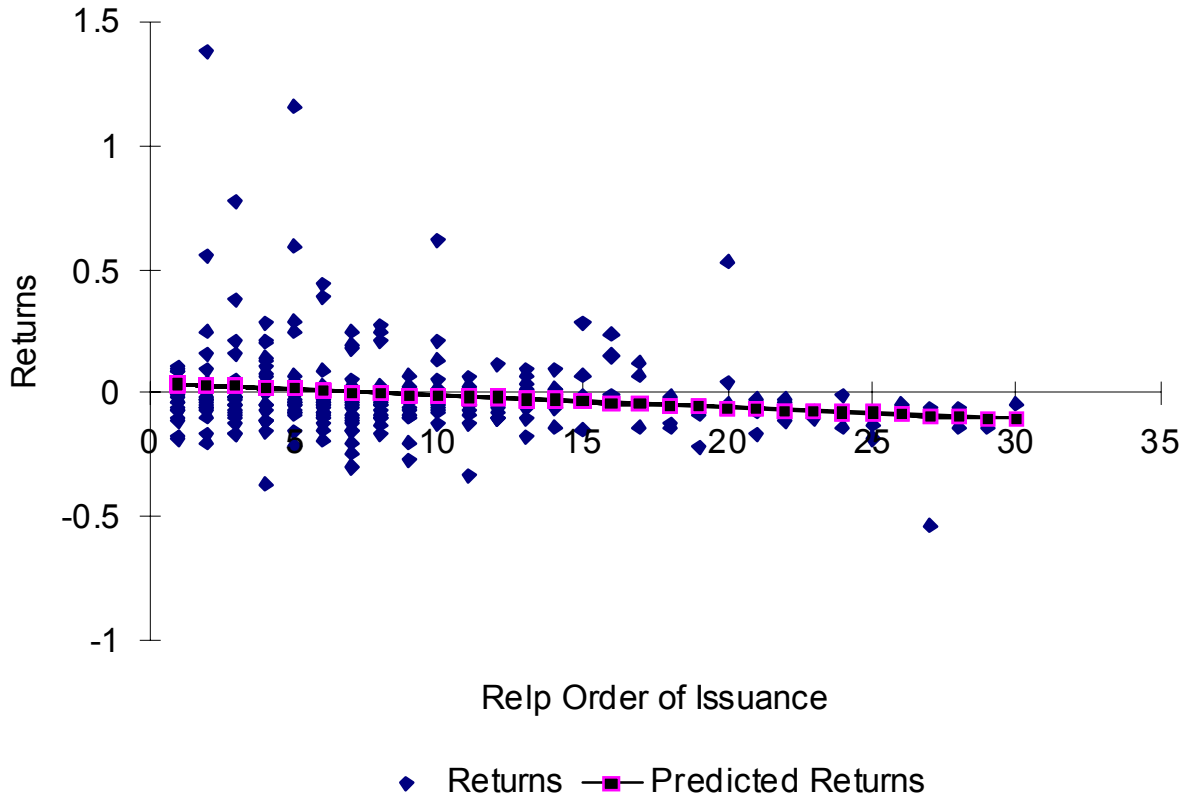
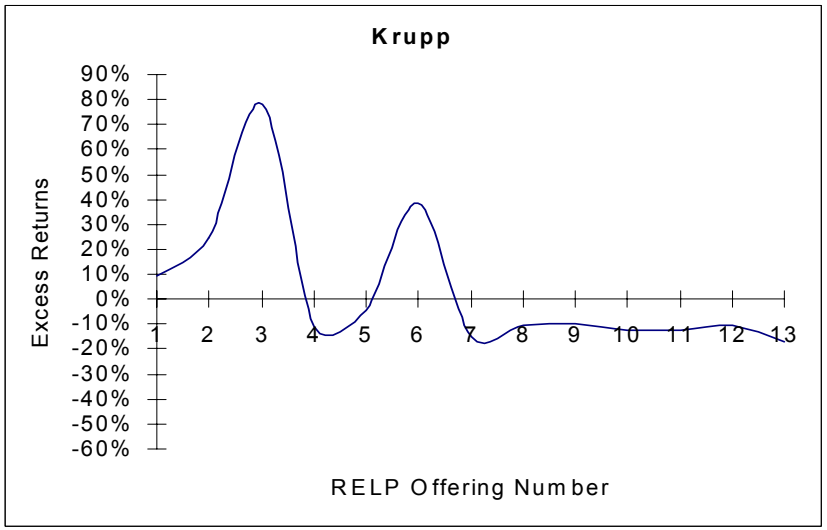
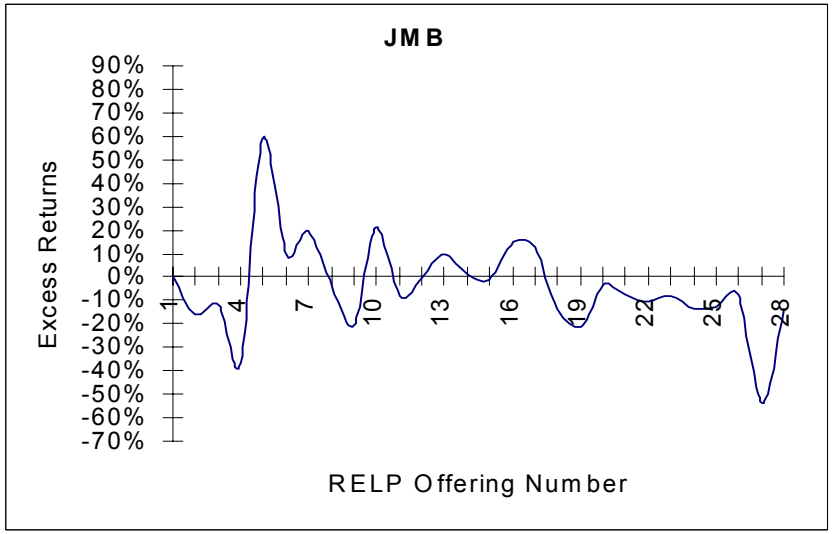
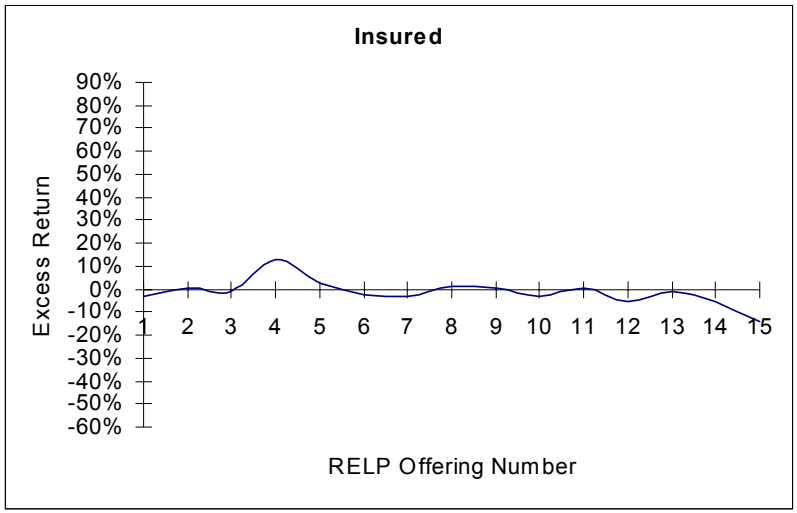


Figure 3: Excess Returns on RELPs by Sponsor

This figure shows the excess returns (adjusted for the year of RELP formation) for the six sponsors analyzed in detail.







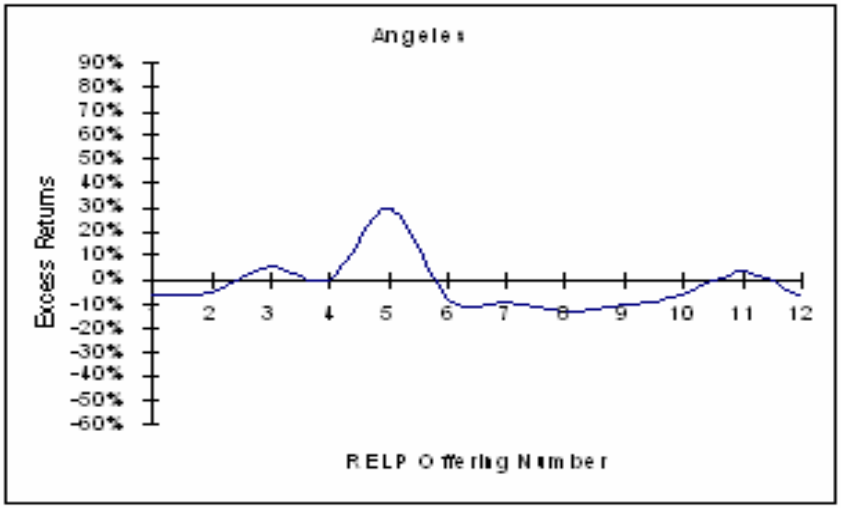
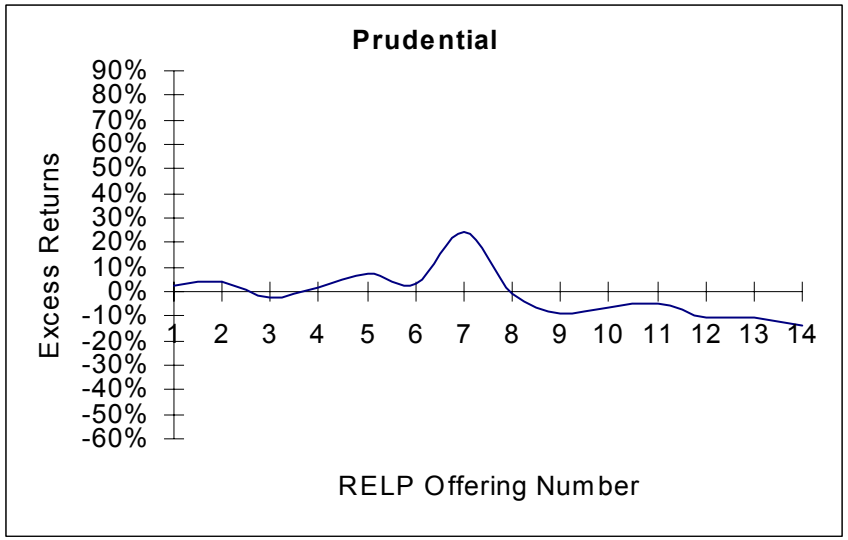


Figure 3: Excess Returns on RELPs by Sponsor (continued)



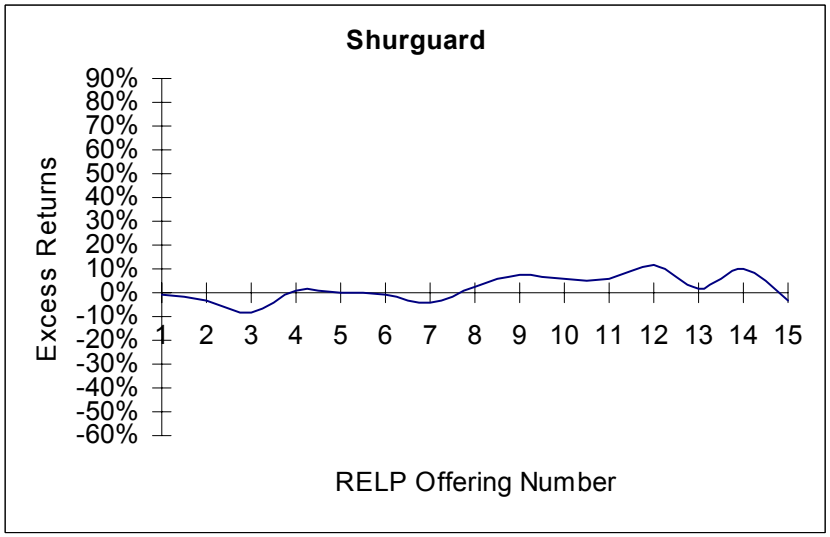
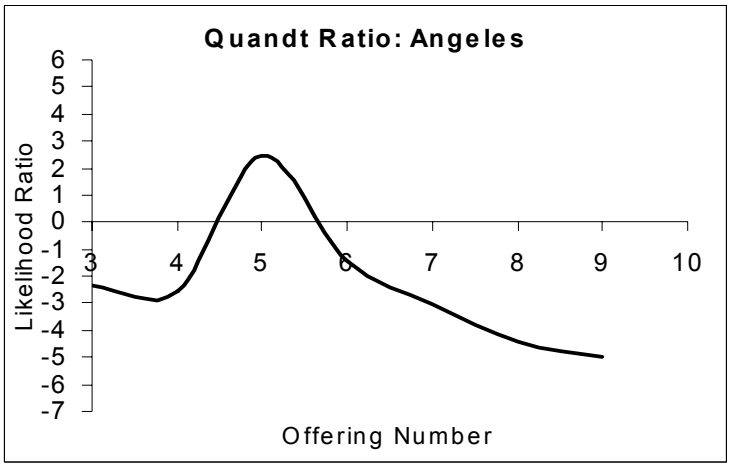
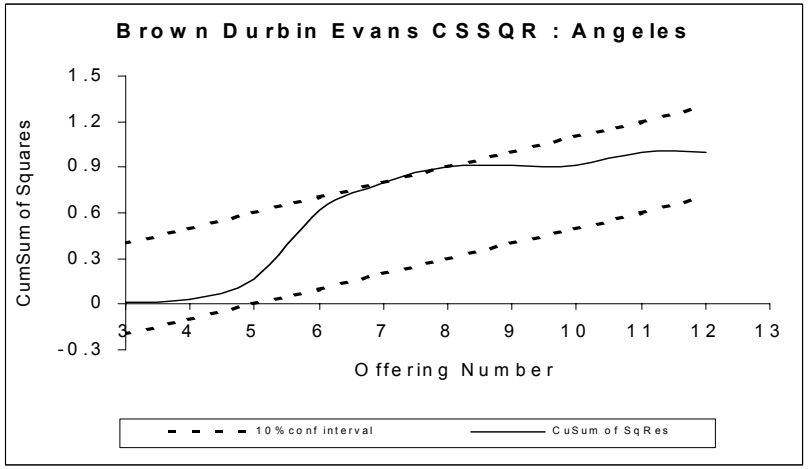
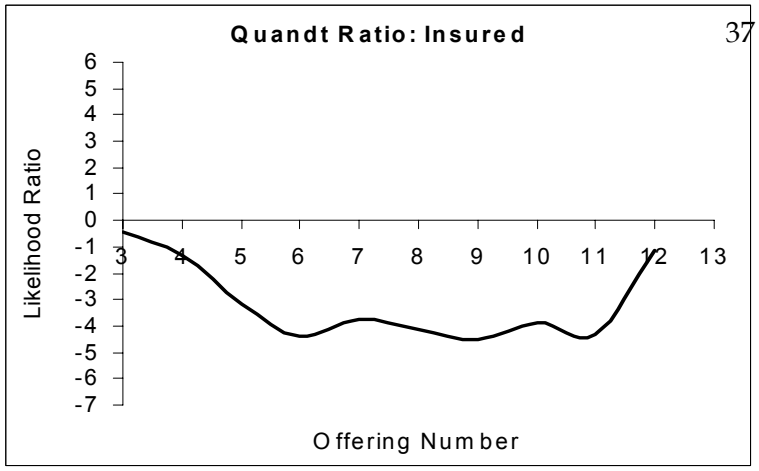


Figure 4: Comparison of Quandt's Log Likelihood Ratio with Brown-Durbin-Evans CuSumSq Residuals

For the six sponsors analyzed in detail, this figure shows the results of Quandt's and Brown, Durbin, and Evans' estimation of regime shifts.







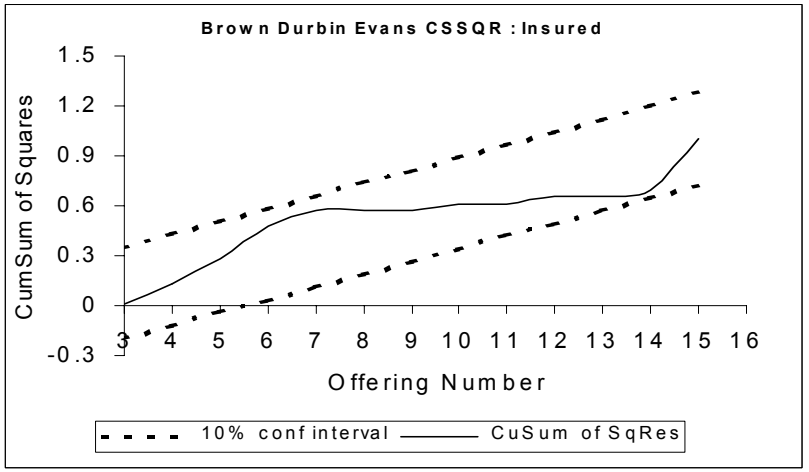
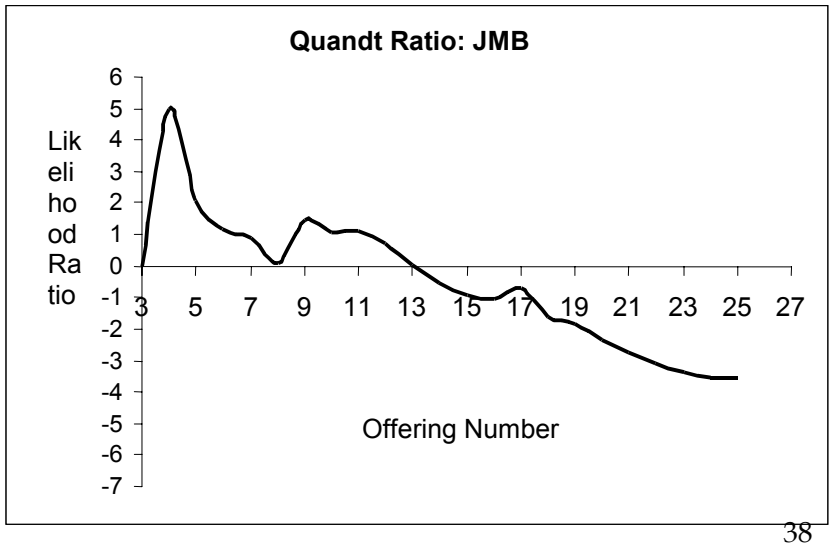
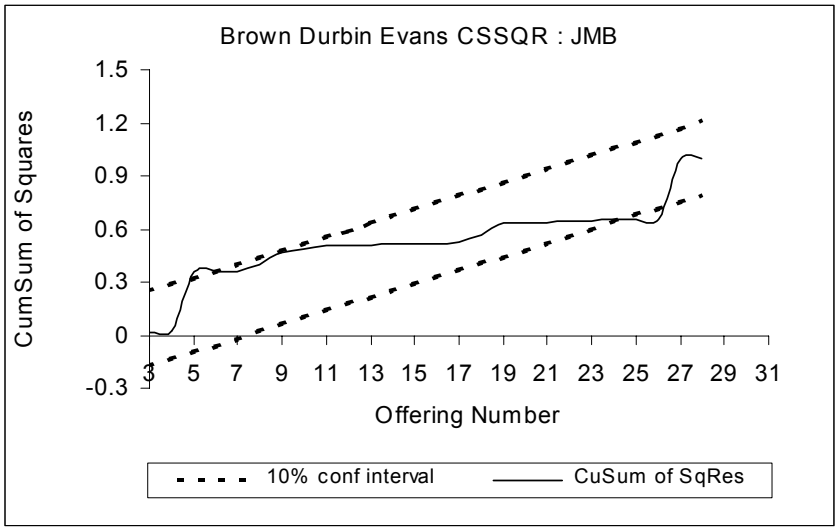
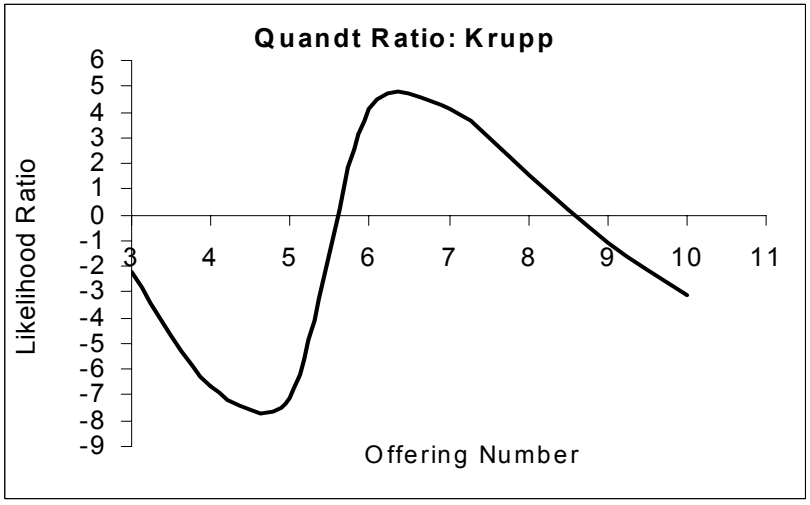


Figure 4: Comparison of Quandt's Log Likelihood Ratio with Brown-Durbin-Evans CuSumSq Residuals







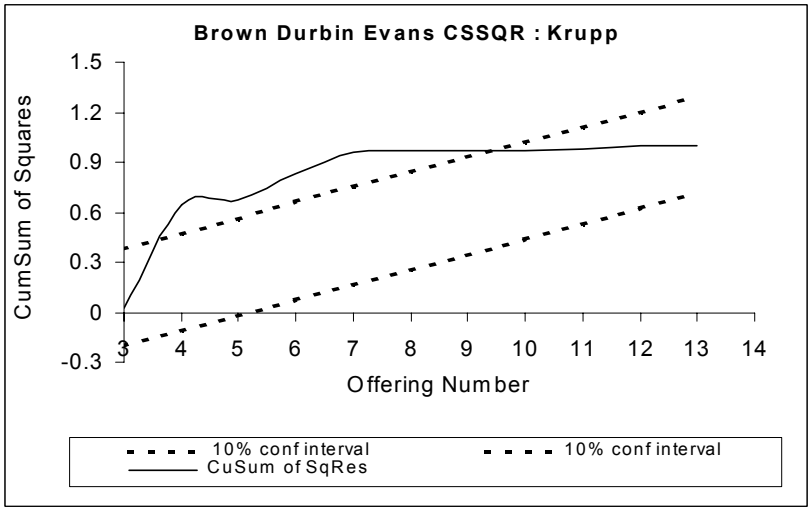
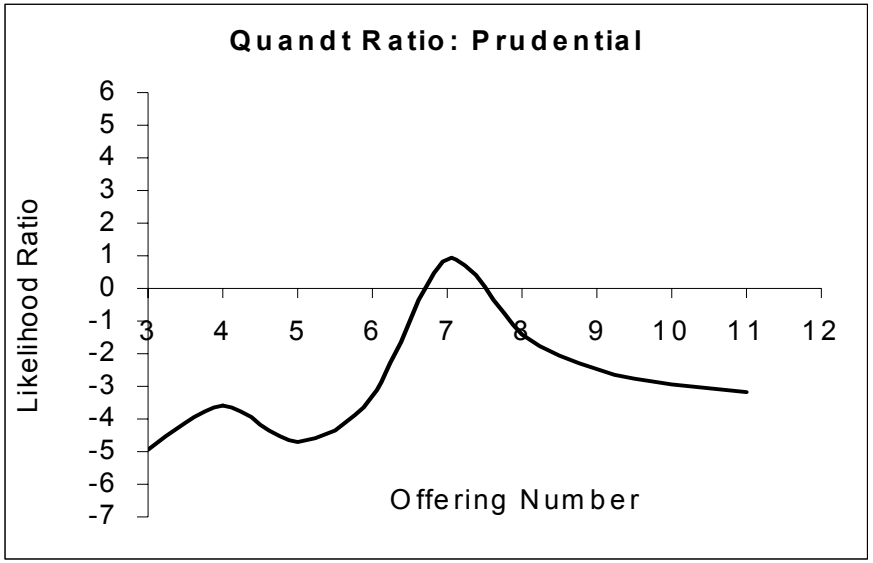
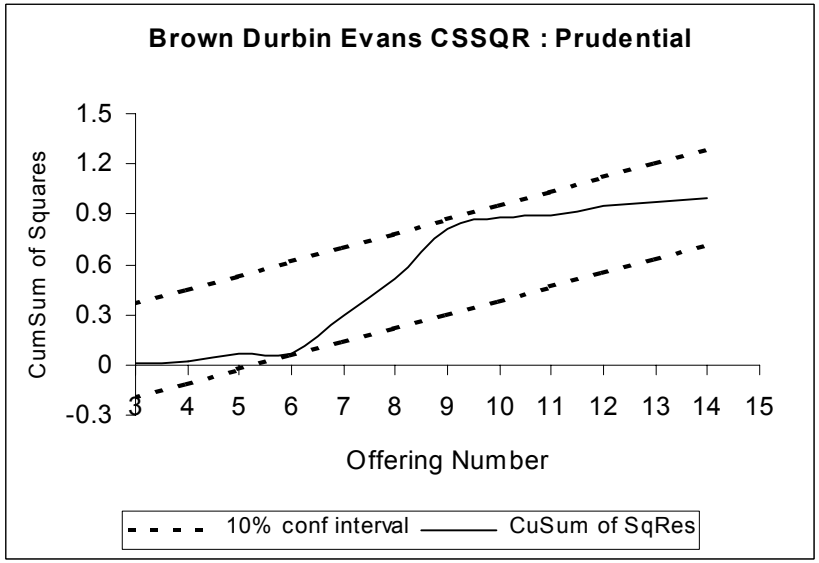
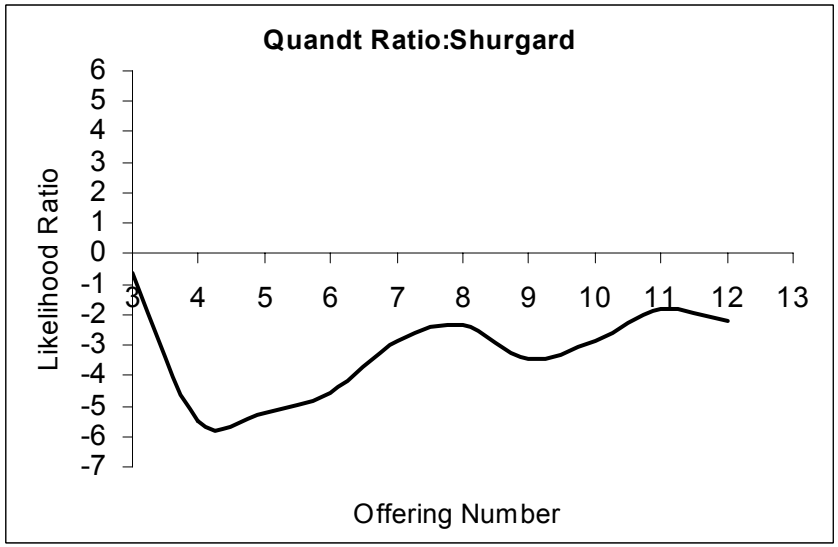


Figure 4: Comparison of Quandt's Log Likelihood Ratio with Brown-Durbin-Evans CuSumSq Residuals







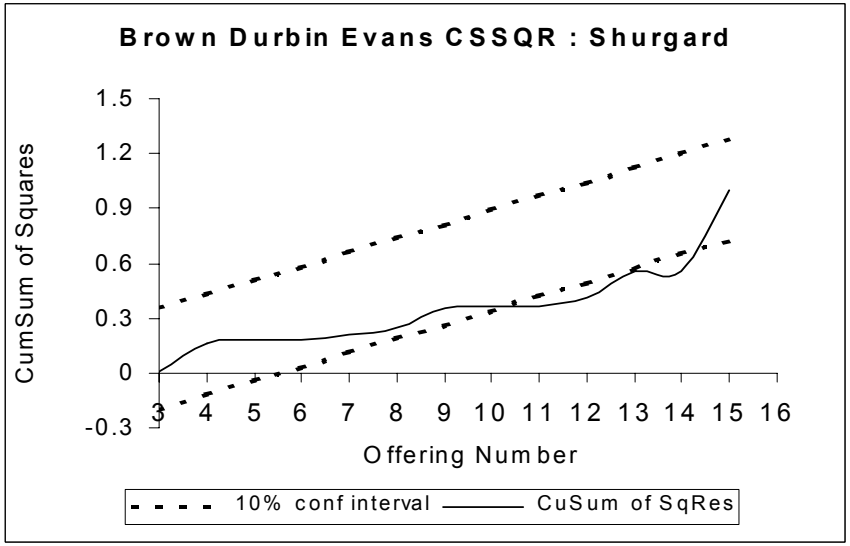


Table 1: Sample Characteristics

Panel A presents descriptive statistics for the complete sample of RELPs. The first 3 rows give the average dividend distributions as a percentage of initial capital from the partnership's inception until 1987, 1988 and 1989. The cost basis of the properties is the total capitalized cost before depreciation, amortization and property value writedowns. Total leverage is measured with respect to the total cost basis of the properties. The Ratings are from Stanger's Partnership Profiles, ranging from 1 (best) to 5. The ratings and the financial statement data are as of the end of 1989.

Panel A: General Characteristics

Statistic	Number of observations	Mean	Standard deviation
Cumulative dividends till 1989	135	25.4%	21.2%
Cumulative dividends till 1988	129	22.8%	19.7%
Cumulative dividends till 1987	104	21.2%	18.2%
Leverage	134	27.3%	29.8%
Operating income (in $000s)	117	2,418	4,004
Financial condition rating	131	1.69	1.1
Cash distribution rating	127	3.35	1.31
Gross revenue (in $000s)	134	7,312	7,506
Cost basis (in $000s)	134	85,489	90,169

Panel B: Characteristics by Partnership Sequence Number

Statistic	1	2	3	4	5
Cumulative dividends till 1989 (%)	39.1	42.6	34.8	30.0	21.9
Cumulative dividends till 1988 (%)	36.5	34.0	34.4	27.3	19.2
Cumulative dividends till 1987 (%)	31.9	34.5	27.9	21.1	16.2
Average year of commencement	1981	1983	1983	1984	1985
Leverage (%)	31.6	23.5	31.1	23.3	28.1
Operating income (in $000s)	1,425	2,174	1,458	3,326	3,374
Financial condition rating	1.85	1.80	2.14	1.93	1.40
Cash distribution rating	3.36	3.15	3.58	3.43	3.27
Gross revenue (in $000s)	5,208	6,218	5,402	7,845	7,315
Cost basis (in $000s)	53,077	64,105	65,778	79,463	85,502

Statistic	6	7	8	9	10
Cumulative dividends till 1987 (%)	22.6	18.5	23.1	16.3	7.6
Cumulative dividends till 1988 (%)	19.4	16.0	22.2	12.4	6.6
Cumulative dividends till 1989 (%)	16.7	11.7	15.3	10.8	4.1
Average year of commencement	1986	1986	1986	1987	1987
Leverage (%)	11.7	21.3	18.4	29.0	38.2
Operating income (in $000s)	4,760	1,773	3,154	1,916	896
Financial condition rating	1.18	1.33	1.44	1.40	2.00
Cash distribution rating	2.91	3.22	3.22	3.20	3.75
Gross revenue (in $000s)	7,576	4,834	6,604	8,341	9,681
Cost basis (in $000s)	88,934	59,297	88.894	103,288	111,885

Table 2: In- and Out-of-Sample Raw Returns by Offering Number

This table reports the mean semi-annual (raw) return by issuance number for the 253 RELPs analyzed (in sample) and for the 52 sponsors that had 5 or fewer RELPs (out of sample). The t-test for mean differences between the in-sample and out-of-sample groups for offering numbers 1 through 5 was insignificant in each case. Only observations 9,11 and 12 in the in-sample group have a return significantly different from 0 at the .10 level.

	In-Sample		Out-of-Sample	
Offer Number	Mean	Count	Mean	Count
1	-1.70%	20	7.26%	20
2	8.93%	20	-3.91%	20
3	3.69%	20	1.89%	7
4	1.31%	20	2.81%	2
5	8.19%	20	-8.01%	3
6	-0.77%	20		
7	-4.85%	18		
8	0.17%	15		
9	-6.46%	13		
10	5.49%	12		
11	-6.15%	11		
12	-4.66%	9		
13	-1.58%	8		
14	-1.13%	6		
15	3.50%	5		
16	12.76%	3		
17	2.31%	3		
18	-8.91%	3		
19	-12.35%	3		
20	18.05%	3		
21	-8.85%	3		
22	-5.49%	3		
23	-8.43%	3		
24	-7.13%	2		
25	-15.48%	2		
26	-5.89%	2		
27	-29.62%	2		
28	-9.55%	2		
29	-13.42%	1		
30	-3.95%	1		

Table 3: Tests for Mixed Strategy Using Normal Mixtures

To estimate the mixture of normals, the following moment generating function (mgf) is minimized using weighted nonlinear least squares with j = 15 to ensure that the corresponding normal equations are of full rank:

$$\sum_{i=1}^{n} \frac{e^{\theta_j y_i}}{n} = \lambda e^{\theta_j \mu_1 + \theta_j^2 \sigma_1^2 / 2} + (1 - \lambda) e^{\theta_j \mu_2 + \theta_j^2 \sigma_2^2 / 2} \qquad j = 1, 2, \ldots, 15$$

Here y_i represents the abnormal return (in percentage) for the ith RELP offering of a sponsor. Parameter restrictions are tested using a Wald test with the level of significance reported in the last column of the following table. The null hypothesis is that $\mu_1 = \mu_2$ and $\sigma_1 = \sigma_2$, i.e., that observations are drawn from a single normal distribution. Here * indicates significant at the .10 level, ** indicates significant at the .05 level.

RELP Sponsor	λ	μ_1	μ_2	σ_1	σ_2	σ_{Resid}	Max θ_j	Min θ_j	Wald Test
Aggregate	.43**	4.7**	–3.6**	2.9	2.0	.0001	.09	–.23	.000**
Angeles	.91**	–5.4**	28.7**	4.5**	2.0	.0008	.19	–.13	.000**
Insured	.01	13.0	–1.5	7.2	5.4**	.0036	.17	–.15	.009**
JMB	.02	18.9**	–4.1**	33.0**	19.8**	.0053	.07	–.08	.000**
Krupp	.30**	44.9**	–11.5**	17.6**	3.2**	.0026	.03	–.25	.000**
Prudential	.88**	–4.1**	21.6**	3.5	3.2	.0027	.21	–.07	.000**
Shurgard	.52	–2.4	6.3	3	3.3	.0014	.15	–.17	.465

Table 4: Tests of Mean and Variance Shifts

This table shows the results of testing for significant differences between the means and variances of sponsor returns in the first and second half of their offerings. Here * indicates significant at the .10 level, ** indicates significant at the .05 level.

	Mean tests t/Hsu statistics	***10% value***	***Variance tests F statistic***	***p-value for F***
Aggregate	1.65*	1.36	1.49	.32
Angeles	1.50*	1.43	6.85**	2.71×10^{-2}
Balcor	0.55	1.31	0.44	0.93
Century	4.87**	1.43	2.44	0.24
CNL	2.12**	1.47	1.68	0.32
Consolidated	1.19	1.43	2.11	0.27
CPA	1.23	1.39	3.15	0.14
Damson	5.23×10^{-2}	1.53	1.55	0.39
Dean Witter	0.51	1.47	2.54	0.22
First Capital	–0.47	1.38	1.48×10^{-2}	0.99
Insured	1.51*	1.35	1.32	0.35
Integrated	0.84	1.36	1.29	0.37
JMB	1.56*	1.31	2.01	0.11
Krupp	2.60**	1.43	139.38**	4.05×10^{-6}
McNeil	0.58	1.41	1.56	0.32
MLH	3.48×10^{-2}	1.53	7.16	0.12
Prudential	3.76**	1.41	4.37**	4.77×10^{-2}
Public Storage	–0.24	1.47	1.42×10^{-2}	0.98
RIC	–0.65	1.38	4.02×10^{-3}	0.99
Shearson	0.84	1.32	0.55	0.81
Shurgard	–3.58	1.35	0.40	0.85

Table 5: Correlation of Median Returns

This table shows correlations between sponsor characteristics and median raw returns. Significance levels are indicated in parentheses. Npart is the number of partnerships that each developer sponsored in our sample; Public is a dummy variable with 1 denoting a sponsor that is publicly traded; SIC is the number of SICs that the developer (or its parent) is engaged in; Devel is a dummy variable with 1 denoting a sponsor that is primarily a developer; Offsize is the total size of all offerings of the developer; Medret is the sponsor's overall median raw return.

	Npart	Public	SIC	Developer	Offsize	Medret
Npart	1.000					
Public	.013 (.958)	1.000				
SIC	.042 (.862)	.629 (.003)	1.000			
Developer	.148 (.532)	−.453 (.045)	−.499 (.025)	1.000		
Offsize	.750 (.000)	−.043 (.857)	.066 (.783)	.127 (.594)	1.000	
Medret	−.035 (.884)	−.217 (.359)	−.366 (.113)	.342 (.140)	−.156 (.512)	1.000

Table 6: Regressions on Dividends Paid

This table displays the results of two regressions with the dependent variable being the sum of all dividends (paid from issuance date to the end of 1989) as a percentage of offering size. Partnership number is the offering number for the given sponsor. PPI financial condition rating is the Stanger rating as of 1989. Operating margin is operating income in 1989 over gross 1989 revenues. Leverage is total debt over the partnership's cost basis as of 1989. Age of the partnership is the number of years from the offering date until 1989. Initial capital raised is total offering size. All regressions use the White correction for heteroscedasticity. The regressions also used fixed effects to account for sponsor characteristics; these coefficients are not shown in order to focus on the more relevant issues. The number of observations varies because of the lack of accounting data for some partnerships.

	Model I Coefficient p-value	Model II Coefficient p-value
Constant	0.408 (.000)	0.327 (.019)
Partnership issuance number	-0.172 (.000)	-0.012 (.029)
PPI financial condition rating		-0.020 (.157)
Operating margin		0.079 (.375)
Leverage (%)		-0.312 (.005)
Age of partnership		0.052 (.000)
Log of initial offering size (in millions)		-0.054 (.006)
Number of observations	134	115
Adjusted R^2	48.5%	77.8%
Regression p-value	.000	.000