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ABSTRACT

The viatical settlement industry provides an opportunity for terminally-ill consumers, typically HIV patients, to exploit a previously untapped source of equity in existing life insurance contracts to finance consumption and medical expenses. The 1996 introduction and dissemination of effecive anti-HIV medication reduced AIDS mortality, but also reduced viatical settlement prices, even holding fixed changes in life expectancy.

Using Freedom of Information Act requests to state insurance regulatory agencies, we have assembled a unique dataset of over twelve thousand viatical transactions from firms licensed in states that regulate viatical settlement markets.

We distinguish two explanations for falling prices---an increase in market power, and a change in market expectations about the likelihood of further improvements in HIV care. We find that both explanations have contributed to diminishing settlement prices over the last decade, but increased market power has been the more important driver in the most recent years. Our estimates imply that the increase in market power of firms reduced the value of life insurance holdings of HIV+ persons by about $1.0 billion.

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1 Introduction

Living in the post-Schumpeterian age, we often view technological progress as a process of creative destruction – that is, the emergence of a new technology leading to the dissolution of an old industry. For example, think of the development of the automobile and the plight of horse-buggy manufacturers at the turn of the 20^{th} century. However, new industries do not always destroy their older counterparts. In fact, sometimes they create entirely new products that enhance the value of older products. In this paper, we study the life cycle of one such industry, the viatical settlement industry, that created an entirely new product which enhanced the value of billions of dollars worth of already existing life insurance policies. The study of this new industry has several important and unique aspects. First, the development and subsequent dissolution of this industry has important implications for consumer welfare, especially of terminally ill consumers, who benefited the most from the emergence of this industry. Second, unlike most industries, where within-industry technological developments are the proximate cause of industrial decline, the relatively rapid decline of this industry was spurred by a technological shock wholly outside of this industry – that is, pharmacological advances in the treatment of HIV/AIDS. Finally, the study of this industry is intellectually appealing, especially for economists, as it presents the rare opportunity to study an industry that owes its very existence to an advance in economic knowledge.

The viatical settlement industry emerged in 1989 in response to the AIDS epidemic. AIDS patients or individuals with other life threatening illnesses are often unable to work and often lack health insurance coverage. Consequently, such people are frequently under extreme financial stress: they need cash now to buy life-saving treatments, but do not have enough income or liquid assets to pay prescription bills. Until recently, the only options for these people were to either default on their payments or borrow against their non-liquid assets such as a house or a cash value life insurance policy.

The viatical settlement industry changed this by providing an opportunity for terminally-ill consumers to exploit a previously untapped source of equity in existing life insurance contracts to finance consumption and medical expenses.

A typical viatical settlement transaction works in the following manner: the policyholder receives an immediate up-front payment at a discount to the face value of the life insurance policy; in return, he makes a third party the sole beneficiary of the policy. The third party collects the death benefits promised by the policy when the policyholder dies, but pays all remaining premiums on the policy while the policyholder is alive. The reason why life insurance policies of individuals with HIV (or other life-threatening illnesses) are valuable to third parties is because premiums were set before the policyholder contracted their disease. Thus, the expected present value of the policy's face value, evaluated *using the mortality rates of the now HIV positive patient*, is greater than the net present value of the premium payments plus the up-front settlement payment. Moreover, the value of the initial up-front payment to the policyholder by the viatical company will be inversely proportional to the life expectancy of the policyholder, since the company collects the full value only when the policyholder dies.

While viatical settlements represent a significant advance in contracting technology and have become an important source of income for persons nearing the end of life, there has been little scrutiny of this industry - and its unusual life-cycle - in the economic literature. Using Freedom of Information Act (FOIA) requests to state insurance regulatory agencies, we have assembled a unique dataset of over twelve thousand viatical transactions from firms licensed in states that regulate viatical settlement markets. Our transaction data are representative (and virtually a census) of the universe of viatical settlement transactions that took place in regulated states between 1995 and 2001. Using these data, we are the first to document the nationwide decline in the number of viatical firms and transactions over this period. For example, in Texas, which was initially the largest viatical market in the U.S., there were 94 percent fewer transactions in 2001 than in 1995. We also identify two other key trends. First, we document a sharp decline in the price of viatical settlements, even after taking into account the improvement in the health of the HIV positive population over that period. In addition, we also find larger reductions in returns for those with longer life expectancies. For example, prices in California dropped by more than 50 percent for policyholders with a life expectancy greater than 3 years, compared to a decline of 20 percent for individuals with less than one year to live.

The technological shock that has triggered this industry's dissolution is the 1996 introduction and dissemination of a set of powerful medications that delay the onset of terminal AIDS symptoms and mortality in HIV infected patients. Collectively, these drugs are known as Highly Active Anti-Retroviral Therapy (HAART), and were a major and unexpected breakthrough in the treatment of HIV. In the wake of their widespread diffusion in the U.S., annual mortality rates among HIV patients declined by 60% between 1996 and 2001 (CDC, 2001; CDC, 2002). Almost overnight, HIV was transformed from a too-quick death sentence into a chronic and manageable illness.

We have two main aims in this paper. The first is to document some basic facts about the structure and performance of the viatical settlement industry for the period between 1995 and 2001, using the data set that we have compiled. With few exceptions, there has been little academic work done on the viatical settlement industry, and as a consequence, such facts are available nowhere in the extant literature. Our second aim is to build a model of the HAART technological shock in this market, estimate the model using our data, and then infer the welfare consequences of the decline in the market for sellers. The key motivation underlying our model is to distinguish two explanations for falling prices—an increase in market power, and a change in market expectations about the likelihood of further improvements in HIV care.

Such an exercise is important for both practical and intellectual reasons. First, even in the post-HAART era, the viatical settlement market represents an important source of financing life-saving medication for many HIV+ patients. In this case, ensuring effective competition is literally a matter of life or death. Second, the contracting innovation that led to the development of the viatical settlement market has been adopted by life insurance companies themselves. The population of policyholders who can now sell their policies has expanded beyond HIV patients to the chronically ill elderly population more generally. As the population ages, these so-called life or senior settlements are becoming increasingly popular. In part this reflects demographic trends, but also the rising costs of treating chronic illnesses (Joyce et al., 2002). Indeed, a 1999 study by the Conning Corporation, a leading insurance research and investment management firm, said that the potential market for life settlements could be “conservatively” estimated at over $100 billion (OFIS, 2002). Finally, the story of this market is a good example of how subtle and unexpected the welfare effects of technological advance can be. In this story, there are at least two important and distinct technological improvements—one in pharmacology, and the other in contracting. The optimal regulation of an industry that has undergone substantial technological change (from both internal and external sources) is a complex challenge, and the more carefully considered examples we have to look at, the better.

2 Basic Facts

Using Freedom of Information Act (FOIA) requests to state regulatory agencies, we have put together a unique database of viatical settlement transactions that is representative of the universe of viatical settlement transactions that took place in regulated states between 1995 and 2001. These state agencies collect annual reports of all viatical firms that purchase such contracts within the state. The database includes information on: face value of policy sold; settlement amount received; life expectancy of the seller at time of sale; date of transaction; premium paid; and, type of policy. We have complete records for seven states: California, Connecticut, Kentucky, North Carolina, New York, Oregon, and Texas. Moreover, California, New York, and Oregon require viatical firms operating there to report on all transactions, regardless of location (that is, in all states). Overall, the dataset represents 32 viatical firms with 12,097 transactions, and includes transactions in every state in the U.S. in at least one year between 1995 and 2001. For our seven states, we have data from all viatical transactions that took place within each state. We provide more details about the construction of this database in the Appendix.

2.1 Market Size

We first examine changes in the total value and number of viatical settlement transactions during the period of the study. Contrary to the trade literature, which has reported a booming viatical industry,[1] our data show a significant decline in the number of viatical transactions and the total value of settlements over the time period (Table 1). In 1995, 2,623 transactions were reported by the firms in our data, yet by 2001, that number had fallen by 91 percent. Without exception, all states recorded fewer transactions in 2001 than in 1995.[2] With the exception of an upward spike in 1998 in some states, the monotonic decline in the number of transactions was matched by a decline in every state in our sample. Meanwhile, the average settlement amount per policy doubled, and the average face amount increased by 5 times

[1] According to the National Viatical Association (1999), the size of the viatical settlements market doubled from \$500 million in 1995 to \$1 billion in 1998 (National Viatical Association, 1999). Erich Sippel and Company, a market research firm specializing in the insurance industry, estimates continued growth with a market size of \$1.2 billion in 1999 and between \$1.8 billion to \$2.2 billion in 2001. The Viatical Association of America, a leading industry association of viatical firms, more optimistically estimates the market size to be \$4 billion in 2001. (Sippel and Buerger, 2002)

[2] States with zero transactions in 1995 also had zero transactions in 2001.

its average in 1995. Yet, despite increasing policy values per settlement, we observe a diminishing total amount viaticated over this period.

Table 1: Transactions in the Viatical Settlement Market, 1995-2001

Year	# of Transactions	Amount Viaticated (millions $)	Face Value (millions $)
1995	2,623	$148.3	$229.6
1996	2,083	121.8	182.9
1997	1,930	104.4	213.7
1998	3,267	174.6	398.2
1999	1,486	84.0	194.7
2000	473	41.2	93.8
2001	235	29.9	107.7
Total	12,097	$704.3	$1,420.6

While the trends are similar across states, we conduct an additional check on our findings by more closely examining those states for which we have collected complete records for the entire time period (CA, NC, NY, OR, TX). In these five states, we find patterns that are similar to the national trend. For example, in Texas—initially the largest regulated market—the number of transactions declined 4% from 1995 to 1998 and an additional 94% between 1998 and 2001. And for each of the five states, we find a decrease in the total value of transactions (in terms of total settlement amount) ranging from 56.1% in Oregon to 97.6% in New York between 1995 and 2001.

2.2 Market Structure

Some of the decline in transactions and settlement value that we have observed may reflect market exit. To avoid misrepresenting the magnitude of the change in the number of firms over time, we again focus our attention on the five states with complete data. Table 2 demonstrates a reduction in the number of firms in each of the five states. In California, New York, and Oregon there was a fairly steady decline, while in Texas and North Carolina, the number of firms peaked during the latter part of the decade and started decreasing shortly before 2001.[3] We also find that the average number of transactions per firm has declined.

Table 2: Number of Viatical Firms by State, 1995-2001

	1995	1996	1997	1998	1999	2000	2001
California	13	11	9	9	9	8	5
New York	11	10	6	9	8	4	2
Texas	11	12	9	14	13	15	11
North Carolina	4	8	6	9	7	6	5
Oregon	5	5	2	3	0	2	1
Total	44	46	32	44	37	35	24

Next, we estimate the Hirschman-Herfindahl Index (HHI) to describe the change in market concentration in this industry over time. We define a market as the total number of transactions in a specific state and year, since individuals in regulated states are only allowed to sell their policies to firms licensed in their state of residence. The results in Table 3 show some evidence of increasing market concentration. In fact, the HHI nearly tripled in New York and California from 1995 to 2001 with the largest increase in concentration occurring in the years 2000 and 2001. The Federal Trade Commission (FTC) considers an HHI index above 1,800 as an indication that the industry may be non-competitive (FTC, 2004). In all five states, the HHI far exceeded this threshold in 2001.

[3]In some high-profile cases, firm exit from this market has been noted in the popular press. For example, in 2001, Viaticus, one of the nation's largest viatical and life settlements firms, publicly announced that it had decided to cease purchasing new policies (see Belth, 2002 or Huntley, 2001).

Table 3: Hirschman-Herfindahl Index by State, 1995-2001

	California	New York	Texas	North Carolina	Oregon
1995	1,575	1,741	6,164	6,485	4,039
1996	4,964	2,976	2,206	3,241	3,858
1997	2,057	2,258	1,940	2,666	9,192
1998	1,502	3,005	2,750	2,110	4,101
1999	2,229	2,101	2,142	2,059	-
2000	2,460	4,308	2,009	2,886	8,717
2001	4,800	5,187	4,034	3,178	10,000
% change	204%	198%	-35%	-51%	148%

2.3 Prices

Next, we examine price trends in this market. Since policyholders *sell* their life insurance policies in this market, lower prices imply lower returns for them. The nominal price of a viatical settlement is the ratio of the amount the policyholder receives from the viatical firm over the face value of his life insurance policy. However, comparing nominal prices across consumers with different mortality risks is not economically meaningful, as the values of benefits received or forgone depend critically on the mortality risk of the consumer. For example, if firms offered the same nominal price to all HIV patients in the viatical settlement market, then firms would be paying a lower economic price to those with advanced disease, as firms are more likely to collect the life insurance benefits of patients with advanced disease in the immediate future. Thus, the higher a person's life expectancy, the lower the nominal settlement price offered by a firm.

Figure 1 shows that average life expectancy of consumers participating in the viatical settlements market increased by 62 percent from 1995-2001. In 1995-96 the majority of transactions were for people with a life expectancy of 2 years or less, but after 1996 firms bought most of their policies from individuals with life expectancies of more than 2 years.

Figure 1: Average Life Expectancy Among US HIV Patients, 1995-2001

Thus, we should expect to find a reduction in average nominal settlement price over this period. We observe that the average price in 2001 was nearly half the 1995 average. However, since price and life expectancy are inversely related, this observation does not reveal whether changes in price over time also signal lower returns for consumers. Hence, we also examine the changes in the nominal price of viatical settlement transactions conditional on the life expectancy of the consumer (Table 4). The data show two salient trends – (1) a dramatic decrease in returns for consumers in 2001 relative to 1995 for each life expectancy category, (2) larger reductions in returns for those with longer life expectancies.

Table 4: Nominal Settlement Price by Life Expectancy

Life Expectancy (months)	Year 1995	1998	2001	% Change (1995-2001)
<12	73.59	71.56	67.94	-7.68%
12-23	71.43	60.91	50.71	-29.01%
24-35	61.65	48.57	38.8	-37.06%
36-47	48.72	36.7	26.89	-44.81%
48+	39.31	27.35	22.32	-43.22%

Note: We dropped data from 244 transactions where life expectancy exceeded 100 months.

The results in Table 3 offer an important clue in explaining the first trend of an overall decline in prices. The data show evidence of increasing market concentration. This increase in market concentration might be associated with rising profit margins and declining prices. Table 5 shows the percent decline in prices between 1995 and 2001 for each life expectancy category in the 3 states with the largest viatical settlement markets. [4] We observe that California, the state with the largest increase in HHI between 1995 and 2001 (see Table 3), generally experienced the largest declines in settlement prices at each life expectancy level. This suggests that increasing levels of market concentration may have explained some of the variation in prices that we observed over this time period.

But what explains the other trend of larger reductions in prices for consumers with longer life expectancies? One explanation is that the unanticipated introduction of HAART changed market expectations about future breakthroughs in treatment, and this change in risk affected prices of consumers with longer expectancies more than those with relatively short lifespans. The intuition behind this is that changes in the market's perception of

[4] Again we consider only states with complete data and exclude Oregon and North Carolina because of their small sample size, with zero observations in certain life expectancy categories.

Table 5: Change in Mean Settlement Price by State

Life Expectancy	California	New York	Texas
<12	-20.00%	-	-5.10%
12-23	-32.10%	-28.20%	-43.50%
24-35	-40.30%	-31.10%	-38.40%
36-47	-56.30%	-29.20%	-46.10%
48+	-53.10%	-73.80%	-30.10%

Note: Settlement prices are measured as a proportion of face value of the original life insurance contract. We dropped data from 89 transactions where life expectancy exceeded 100 months.

risks would increase the risk premiums that lenders would charge (above the risk free interest rate) to the viatical industry. This change in cost of capital (due to technological advance) would affect prices of longer life expectancies more, as these policies involve higher financing costs (interest charges) since firms need to borrow capital for a longer duration before they receive payoffs on their purchases. In other words, since firms only collect when the policyholder dies, the longer the time horizon for the payoff, the higher the effect of changes in cost of capital on the nominal price. The larger reductions in prices for consumers with longer life expectancies is also consistent with the intuition that consumers with longer life expectancies are more likely to survive to enjoy the benefits of future breakthroughs in treatment.

In the remainder of this paper we measure how well these two distinct stories – increases in market power due to higher market concentration, and changes in market expectations about future innovations and the risks involved in purchasing policies from terminally ill consumers – explain prices in this market.

3 Viatical Settlements Economics

This section develops an economic model of viatical settlement prices that encompasses the effects of both changes in market power and market expectations on prices. We begin our modeling with the observation that anyone who undergoes an unexpectedly large health shock after buying a life insurance policy and has a strong demand for immediate disposable income will have an incentive to cash out their life insurance policy. Prior to the advent of the viatical settlements market in 1989 (Belth, 2002), these individuals surrendered their policies to their life insurance carrier for a predetermined amount independent of their health status. However, since this amount was uniformly assigned to all policyholders based on the assumption of a normal path of health, this surrender value did not fully compensate the policyholder for his policy's increased economic value that had resulted from a shortened lifespan (Doherty and Singer, 2003).

The value of a viatical settlement contract to a potential buyer is simply the present value of the expected death benefits from the purchase of the life insurance policy less the present value of the expected premium payments on the policy. Thus the value of a viatical settlement contract to potential buyers (viatical firms) will depend on the assessment of the mortality risks of the insured.[5] Viatical contracts with high mortality risk consumers would be more highly valued, as viatical firms would expect to collect the life insurance benefits of these patients in the nearer term. In addition, the price that firms will be willing to offer for a policy will depend on the cost of capital, or the interest rate at which firms can borrow, with higher cost of capital implying lower prices. In turn, the cost of capital for this industry depends on the market's perception of risks associated with this industry. For example, unanticipated increases in life expectancy (a negative shock to returns for the

[5] Typically these firms use the services of in-house staff, independent physicians, actuaries and other consultants to determine the mortality risks of potential consumers (NAIC, 1999).

viatical industry) will increase the cost of capital for this industry. Finally, as in all industries, prices will also depend on market structure, with more competition implying higher prices.[6]

3.1 Survival and Settlement Value

We will need some notation. Consider a consumer with a term life insurance policy with face value $\bar{F}$, associated per period premium π (per dollar of coverage) and term length T. Let the sequence of mortality hazards in each period $t = 0 \ldots T$ be given by $\lambda(t)$, which equals the probability of dying in period t, conditional on surviving up to period $t-1$, given existing mortality information at the time of sale of the policy ($t = 0$).[7]

Let Ω_τ represent the information set at calendar time τ regarding the discovery and adoption of new treatments that lead to reductions in mortality. Let $\beta_\tau = \frac{1}{(1+r_\tau+\delta_\tau)}$ be the market discount rate for supplying funds to the viatical settlements market. Here, r_τ is the risk-free interest rate, and δ_τ is the risk premium charged to viatical settlement firms at calendar time τ given the information set Ω_τ. We assume δ_τ increases with market expectations about possible adoption and discovery of new treatments. In other words, lenders charge a higher risk premium if they anticipate negative shocks to the returns of the viatical settlement industry. Thus, the expected present value of the death benefits (net of premium payments) of this policy at calendar time τ is given by:

$$PV_\tau = \sum_{t=0}^{T} \left[D(t)\, \beta_\tau^t \bar{F} - S(t)\, \beta_\tau^t \pi \bar{F} \right] \tag{1}$$

Here, $D(t)$ is the probability of dying t time periods after the sale of the policy, and $S(t)$ is the probability of surviving at least t time periods

[6] Since consumers are sellers in this market, an increase in profit margins for firms means lower prices for consumers.

[7] We assume that this information is publicly available from existing epidemiological and clinical studies.

after the sale of the policy. Equation (1) shows that the contribution of each period to the expected present value is simply the probability of receiving life insurance benefits in that period multiplied by the present value of the benefits in that period, less the probability of paying premiums in that period multiplied by the present value of the per period premium payment.

Thus, the true economic price of a viatical settlement contract is the present value of death benefits forgone less the settlement amount received by the consumer, all measured per unit face value:

$$P_\tau \equiv \sum_{t=0}^{T} \left[D(t,\tau)\,\beta^t - S(t,\tau)\,\beta^t \pi \right] - \frac{S}{\bar{F}} \tag{2}$$

In equation (2), we have normalized prices so that higher prices imply higher returns for firms and lower returns for consumers.

3.2 Price and Market Power

To model the market power, we consider a standard oligopolistic model with no product differentiation—N identical viatical firms in the market charging a single economic price. We define the relevant market as all transactions in a particular state since, as mentioned earlier, residents of a state are only allowed to sell their policies to firms licensed in that state.

To simplify the model, we posit that there are $K_{\tau s}$ potential consumers at calendar time τ in market s, each with a life insurance policy with face value of $\bar{F}$. Each consumer has a reservation price ceiling θ_i; that is, consumer i is willing to sell his life insurance policy if the price charged by viatical firms is less than θ_i. We assume that firms do not observe the reservation price for individual consumers but know the cumulative distribution of the reservation price $F_{\tau s}(\theta)$.[8] Thus $K_{\tau s} F(P_{\tau s})$ consumers will sell their policy

[8] In related research—Bhattacharya, Goldman, and Sood (2004)—we show that the reservation price of a consumer will depend on his degree of time preference, risk aversion, bequest motives, and proportion of assets held as life insurance, and life expectancy. Since firms do not observe most of these characteristics (with the exception of life expectancy)

at a market price $P_{\tau s}$. For convenience, we express this relationship as the inverse market supply curve $P_{\tau s}\left(Q_{\tau s}\right)$.

$$P_{\tau s} = P_{\tau s}\left(Q_{\tau s}\right) \equiv F_{\tau s}^{-1}\left(\frac{Q_{\tau s}}{K_{\tau s}}\right) \tag{3}$$

Where $F_{\tau s}^{-1}\left(.\right)$ is the inverse of the cumulative distribution function of the reservation price; $Q_{\tau s}$ is the total supply of life insurance policies in the market at time τ, which is simply the sum of individual purchases by firms in the market. Thus, the profit function of each firm j at time τ in market s is:

$$\Pi_{j\tau s} = \left(P_{\tau s}\left(Q_{\tau s}\right) q_{j\tau s} - cq_{j\tau s}\right)\bar{F} \tag{4}$$

The first term in equation (4) is the expected present value of the revenues from the purchase of policies less the settlement amount paid to consumers for the purchase. The second term is the underwriting and administrative cost of acquiring the policies. We assume that all firms are identical and face the same underwriting and administrative costs c, as a percent of face amount, per policy. Differentiating the profit function with respect to output yields the firm's profit maximizing first order condition:

$$\frac{\partial \Pi_{j,\tau s}}{\partial q_{j\tau s}} = P_{\tau s} + q_{j\tau s}\frac{dP_{\tau s}}{dQ_{\tau s}}\left(1 + \vartheta_{j\tau s}\right) - c = 0 \tag{5}$$

The first order condition is a modified version of the familiar marginal revenue equals marginal cost condition. As usual, different values of the conjectural variation term, $\vartheta_{j\tau s} = \frac{dQ_{-j\tau s}}{dq_{j\tau s}}$ imply different conclusions about market structure and firm behavior. For example, assuming $\vartheta_{j\tau} = 0\ \forall j$ implies the Cournot model, while assuming $\vartheta_{j\tau s} = -1\ \forall j$, implies the Bertrand oligopoly model where competition among firms lead to marginal cost pricing. At the other extreme, $\vartheta_{j\tau s} = \frac{Q_{\tau s} - q_{j\tau s}}{q_{j\tau s}}\ \forall j$ implies collusion among firms

at the time of the viatical settlement contract, it is realistic to assume that firms do not observe the reservation price.

and leads to monopoly pricing with prices higher than marginal costs.

Multiplying equation (5) by the market share of each firm yields:

$$\frac{\partial \Pi_{j\tau s}}{\partial q_{j\tau s}} = s_{j\tau s} P_{\tau s} + s_{j\tau s}^2 Q_{\tau s} \frac{dP_{\tau s}}{dQ_{\tau s}} \left(1 + \vartheta_{j\tau s}\right) - s_{j\tau s} c = 0 \tag{6}$$

Let $\eta_{\tau s}$ be the price elasticity of the supply of life insurance policies to the viatical market and let $HHI_{\tau s}$ be the HHI. By definition, $\eta_{\tau s} = -\frac{dQ_{\tau s}}{dP_{\tau s}} \frac{P_{\tau s}}{Q_{\tau s}}$. Aggregating equation (6) over all firms in the industry and some algebra yields the following:

$$\frac{P_{\tau s} - c}{P_{\tau s}} = \frac{HHI_{\tau s} + \sum_j \left(\frac{q_{j\tau s}}{Q_{\tau s}}\right)^2 \left(\vartheta_{j\tau s}\right)}{\eta_{\tau s}} = k_{\tau s} \tag{7}$$

Equation (7) is the familiar Lerner Index equation and shows that the price cost margin at time τ in market ($k_{\tau s}$) is determined by market conditions (price elasticity) and by the strategic interaction of firms at that time. If firms exhibit Bertrand behavior then the price cost margin is zero. Similarly, if firms exhibit Cournot behavior then the price cost margin is the ratio of the HHI and the price elasticity of demand. Substituting for P_τ from equation (2) in equation (7) yields:

$$S_{i\tau s} = \left\{ \left(\sum_{t=0}^{T} \left[D\left(t\right) \beta_\tau^t - S\left(t\right) \beta_\tau^t \pi \right] \right) - \frac{c}{1 - k_{\tau s}} \right\} \bar{F} \tag{8}$$

Equation (8) shows that the equilibrium settlement amount received for a policy increases with the present value of the policy and decreases with underwriting and administrative costs. In particular, changes in the settlement amount over time (for a given mortality profile) occur for two very different reasons. First, when lenders perceive a higher likelihood of future life-saving technological advances, they charge a higher risk premium for the provision of capital to firms; in particular, we posit that after the discovery of HAART drugs, δ_τ increased. On the other hand, firms might offer a lower settlement amount if they become less competitive, that is, k_τ increases over time. The extent to which the change in market expectations and the change in profit margins explain the observed variation in price is an empirical question

Equation (8) also shows that the effect of changes in market power on the settlement amount received is independent of the life expectancy of the seller of the policy. By contrast, the effect of changes in expectations about new treatments is dependent on the life expectancy of the seller. We use this key insight to separately identify changes in firms' market power and the markets' expectation of decline in AIDS related mortality due to discovery and adoption of new treatments for HIV.

3.3 Identification

The data we use in our estimation contain the following information on each viatical transaction—settlement amount received (S), the date and year of transaction (τ), face value of policy sold ($\bar{F}$), and life expectancy of patients at the time the policy was sold.

However, despite the detailed data on each transaction, we cannot estimate equation (8) without some further assumptions. In particular, we need to parameterize the mortality hazard profile of the consumer. This is necessary, as we need to calculate the expected present value of each life insurance policy sold in the viatical settlement market. Equation (2) shows that calculation of the expected present value of the death benefit of a policy requires information on the mortality hazard profile of the policyholder. Since our data on viatical transactions report only the life expectancy of the seller, we assume a constant mortality hazard parameterization—$\lambda(t) = \lambda\ \forall t$, where λ is simply the inverse of the life expectancy of the policyholder. Given this parameterization, and after some algebraic manipulation, the present value of an infinite term life insurance policy—equation 1—sold in year τ can be expressed as:

$$PV_\tau = \left[\frac{(\lambda - \pi)(1 + r_\tau + \delta_\tau)}{(\lambda + r_\tau + \delta_\tau)}\right]\bar{F} \tag{9}$$

If the settlement amount ($S_{i\tau s}$) for the i^{th} transaction in year τ and market s is observed with orthogonal measurement error ε_i, equation (8) can be rewritten as:

$$\frac{S_{i\tau s}}{F_{i\tau s}} = \left(\left[\frac{(\lambda_i - \pi_i)(1 + r_\tau + \delta_\tau)}{(\lambda_i + r_\tau + \delta_\tau)}\right] - \frac{c}{1 - k_{\tau s}}\right) + \varepsilon_i \tag{10}$$

In Figures 2 and 3, we illustrate the change in settlement amount received for consumers with different life expectancy due to changes in market power (k_τ) and due to changes in risk premium (δ_τ). For the purpose of this illustration we assume that each consumer has a life insurance policy with a face value of \$100,000, underwriting costs are \$10,000 per transaction, costs of borrowing are 4% per annum, and there are no premium payments on the policy.

Figure 2 shows that change in the market power causes the same absolute change in settlement amount irrespective of the life expectancy of the seller; that is, such a change causes a parallel shift in the offer-curve. In contrast, Figure 3 shows that changes in risk premium causes a higher absolute change in the viatical prices for persons with relatively high life expectancy. Thus, Figures 2 and 3 show that even though we cannot directly observe firms' competitive behavior and market expectations about future treatments, changes in these two parameters can be separately identified as they produce very distinct patterns of changes in the settlement amount.

4 Empirical specification

To estimate our model, we use data on viatical settlement transactions by consumers residing in the five states for which we have complete data to estimate the parameters of equation (8) separately for three time-periods

Figure 2: Changes in prices due to changes in market power

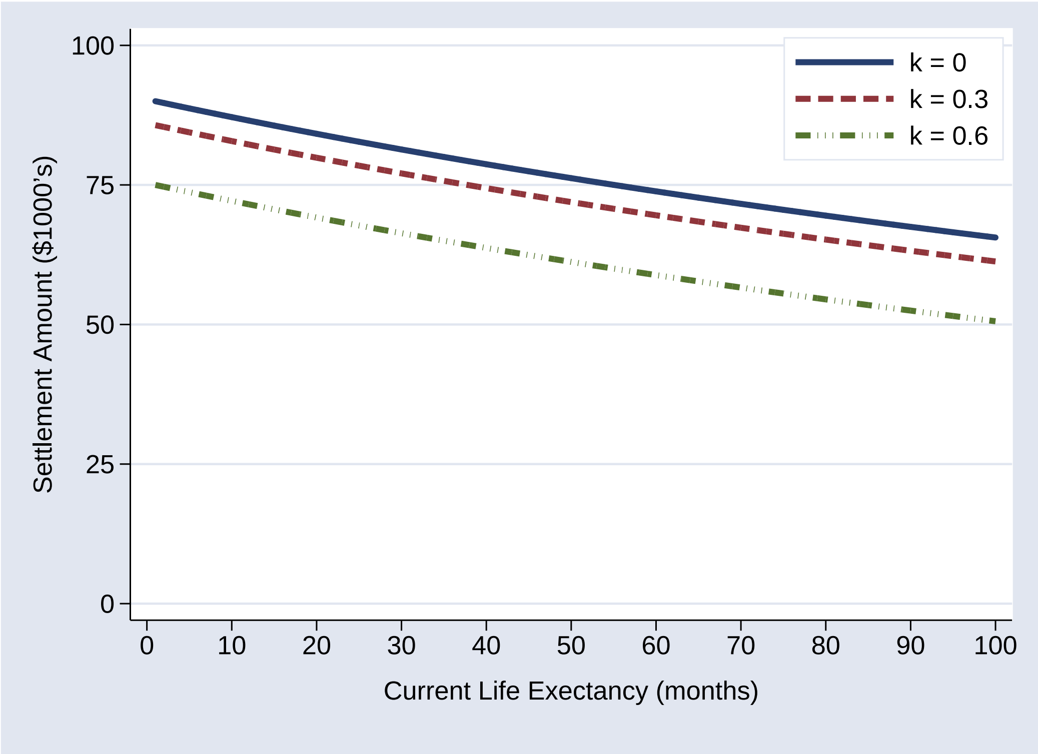
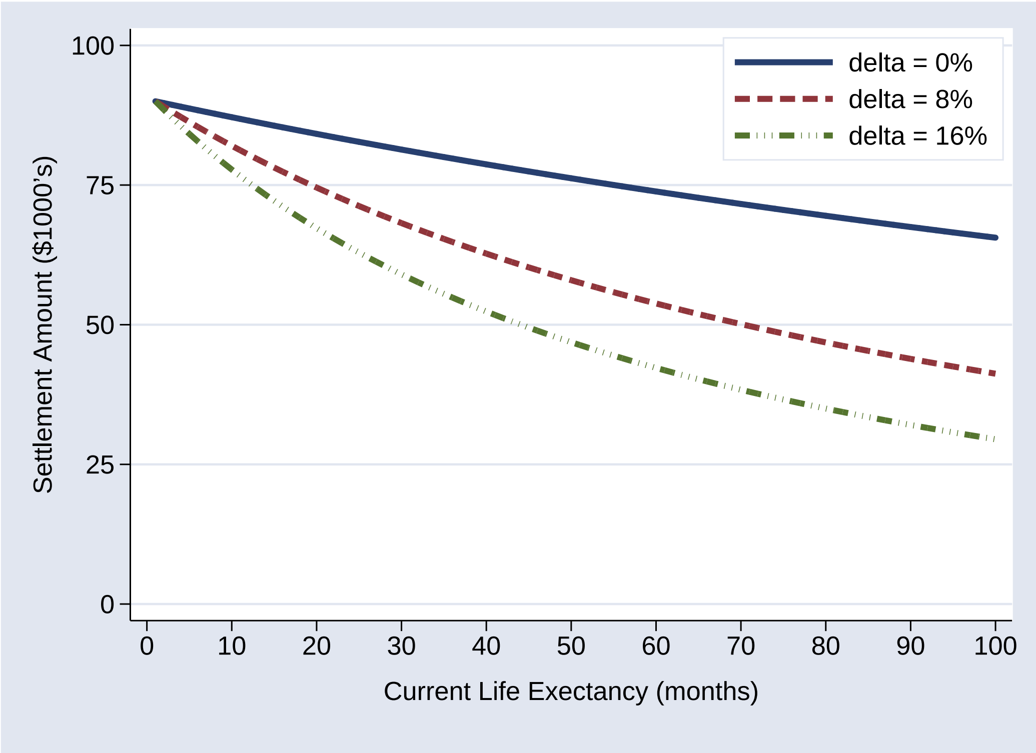


Figure 3: Changes in prices due to changes in risk premium

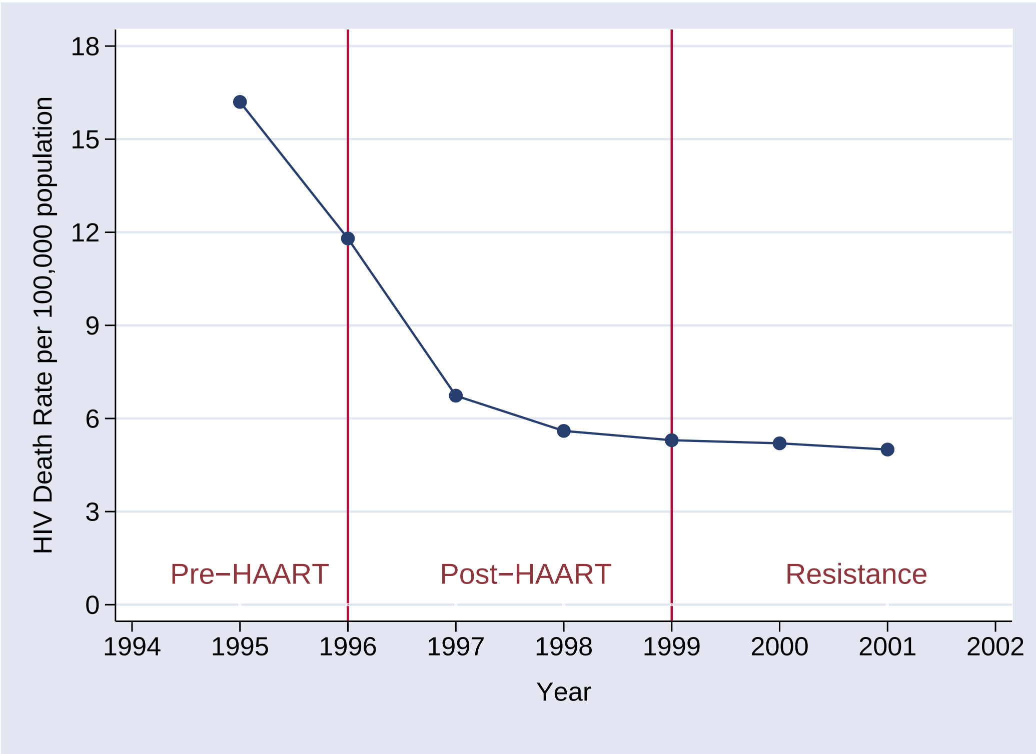


(1995, 1996-98, 1999-01). We choose these intervals because they track important milestones in the adoption and diffusion of HAART, which have had a substantial impact on the mortality profiles of viatical consumers with HIV disease. HAART, and its unprecedented ability to reduce viral loads to almost undetectable levels, was first introduced in early 1996. This drug therapy was rapidly adopted by HIV patients over the next couple years. By 1998, most American HIV patients were on some variant of HAART, and as a result death rates from HIV infection fell dramatically, as illustrated in Figure 4.

However, while age-adjusted death rates fell 47 percent in the U.S. from 1996 to 1997, following a 25 percent decline the year before (CDC, 1997), the mortality decline leveled off after 1998, with a decline of only 6 percent between 1999 to 2001. We classify the period before 1996 as the "Pre-HAART" era and the period with the most significant HAART gains from 1996-1998 as the "Post-HAART" era. Finally, during the period 1999-2001 death rates from HIV stopped declining and the medical literature raised concerns that the AIDS virus was developing resistance to treatment with HAART (HIV-dent, 2000). Thus, we classify this time period as the "Resistance" era.

We now reexamine the relationship between settlement prices and consumers life expectancies across the three time periods defined above. Figure 5 plots the predicted values from OLS regressions of settlement prices on consumers' life expectancies for the three time periods in our analysis. We find that the offer-curve pivots in the post-HAART era (compared to pre-HAART era), with greater absolute changes in prices for consumers with higher life expectancies relative to those with lower ones (analogous to Figure 3). This provides preliminary evidence that changes in the risk premium (δ_τ) had the most significant impact on prices between the pre- and post-HAART periods. The change in offer curve between the pre-HAART and Resistance time periods is starkly different. We observe, a downward parallel shift in the offer curve between the pre-HAART and Resistance time periods (analogous to

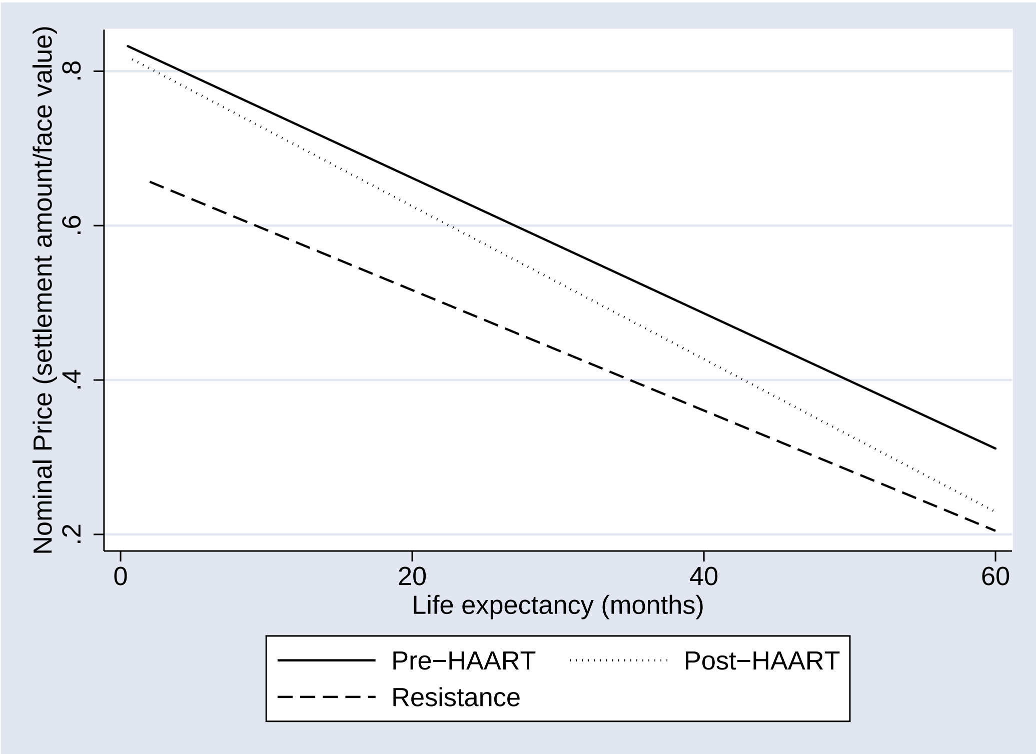
Figure 4: US AIDS Death Rate per 100,000, 1995-2001



Source: CDC HIV/AIDS Surveillance Report 1993-2001, Year-end editions; CDC HIV Mortality L285 Slide Series 2000.

Figure 2). This suggests that increase in market power ($k_{\tau s}$) rather than δ_τ might explain most of the price decline observed in the Resistance era. Next, we estimate the precise impact of each of these two factors on prices.

Figure 5: Changes in prices, by life expectancy and time period



To account for changes in market power we employ a reduced form model. Thus, instead of estimating $\{\eta_\tau, \vartheta_\tau, k_\tau, c\}$ for each time period, we estimate a separate intercept $\left(\alpha_{\tau s} = \frac{c}{1-k_{\tau s}}\right)$ for each time period and state. The independent variables in the model are: the reported life expectancy of the policyholder based on current treatments for HIV/AIDS $\left(\lambda = \frac{1}{LE_{current}}\right)$, face value of the policy ($\bar{F}$), the per period premiums on the policy ($\pi\bar{F}$), the risk free interest rate (r_τ), which we assume to be the yield on 3-month US treasury bills.

We estimate the following parameters: the time and market varying intercept terms $\alpha_{\tau s}$ which captures changes in market power ($k_{\tau s}$), and δ_{τ} which measures the risk premium for the industry. As we have seen in section 3.3, the latter parameters are identified by changes in settlement prices over time and across markets, while the former are identified by changes across states only.

In previous work, which uses a nationally representative database of HIV patients in care from 1996-1998, we find that HIV patients with low life expectancies are overly optimistic about their chance of survival (relative to actuarial death rates), at least with respect to their behavior in viatical settlement markets.[9] This result from the post-HAART period suggests that, in addition to affecting demand elasticities through changes in the cost of capital, mortality profiles may also affect the supply elasticity (consumers' willingness to sell their life insurance policies). To accommodate this possibility, we estimate a second specification in which the intercept term $\alpha_{s\tau LE}$ is permitted to vary with state, year, and the policyholder's life expectancy. We define the policyholder's life expectancy categorically as either one year or less or greater than one year. We estimate the parameters of equation (10) using Nonlinear Least Squares (NLLS).

5 Results and Discussion

Tables 6 and 7 below show our estimates of equation (10)'s parameters. We observe a significant increase in risk premiums (δ_{τ}) between the pre- and post-HAART periods in both specifications that mirrors the considerable contemporary optimism about the life prolonging effects of HAART and the possibility of new treatment breakthroughs. However, between the post-HAART and Resistance periods, the monthly risk premium declined by 32 percent in the first specification and by 52 percent in the second. After the

[9] See Bhattacharya, Goldman, and Sood (2003).

initial euphoria of success, pessimism about the possibility of future advances apparently crept back, as death rates from AIDS leveled and the medical literature warned that the HIV virus may be developing resistance to HAART. Moreover, during this period, clinical studies which evaluated the longer-term effectiveness of HAART became available, thus increasing the level of certainty with which firms could predict the life expectancy of individuals with AIDS (e.g. Gulick, 2000; Lucas, 1999; Gulick, 1998; Hammer, 1997).

Table 6: Monthly Risk Premium estimates from NLLS regressions

Variable	(1)	(2)
δ_{1995}	0.011	0.017
	(0.001)	(0.003)
$\delta_{1996-1998}$	0.020	0.025
	(0.001)	(0.004)
$\delta_{1999-2001}$	0.014	0.012
	(0.002)	(0.002)
N	7,453	7,453
R^2	0.95	0.95

Note: In model (1), α varies by time period and state; in model (2), α varies by time period, state, and life expectancy. Robust standard errors in parentheses. We exclude all observations where the internal rate of return exceeds 0.4 or life expectancy exceeds 100 months. All estimates statistically significant at the 1% confidence level.

Meanwhile, in Table 7, our estimates of α (which tracks market power) follow an opposite pattern. For example, in California we observe a 32 percent decline in $\alpha_{\tau s}$ from 1995 to 1996-98, and a subsequent increase of nearly 200 percent in the final period. A similar trend is observed for all states in this specification. Our estimates suggest a recent increase in market power, which may be an indication of oligopsony power by firms in the viatical market. It is plausible that this increase in market power has resulted from the significant firm exit observed in this market. In fact, New York, the state with the

Table 7: Price-cost margin estimates from NLLS regressions

	(1)	(2)		
	α	$\alpha_{LE\leq 12}$	$\alpha_{LE>12}$	$\alpha_{LE\leq 12} \neq \alpha_{LE>12}$ (p-value)
California				
1995	0.107	0.124	0.019	< 0.001
	(0.011)*	(0.018)*	(0.027)	
1996-1998	0.073	0.077	0.027	< 0.001
	(0.011)*	(0.020)*	(0.028)	
1999-2001	0.214	0.235	0.229	0.799
	(0.018)*	(0.021)*	(0.029)*	
New York				
1995	0.095	0.072	0.016	0.007
	(0.013)*	(0.021)*	(0.028)	
1996-1998	0.069	0.049	0.027	0.186
	(0.012)*	(0.022)**	(0.028)	
1999-2001	0.219	0.224	0.236	0.605
	(0.018)*	(0.024)*	(0.028)*	
Texas				
1995	0.144	0.084	0.078	0.624
	(0.012)*	(0.020)*	(0.028)*	
1996-1998	0.104	0.075	0.062	0.208
	(0.012)*	(0.021)*	(0.028)**	
1999-2001	0.263	0.26	0.282	0.257
	(0.018)*	(0.021)*	(0.028)*	
Oregon				
1995	0.137	0.16	0.028	0.034
	(0.032)*	(0.048)*	(0.048)	
1996-1998	0.037	-0.028	0.000	0.755
	(0.027)	(0.088)	(0.038)	
1999-2001	0.04	0.028	0.07	0.705
	(0.057)	(0.087)	(0.075)	
North Carolina				
1995	0.121	0.186	0.017	0.001
	(0.025)*	(0.045)*	(0.037)	
1996-1998	0.071	0.046	0.028	0.353
	(0.013)*	(0.025)***	(0.029)	
1999-2001	0.16	0.174	0.176	0.965
	(0.022)*	(0.037)*	(0.032)*	
N	7453	7,453	7,453	
R^2	0.95	0.95	0.95	

Note: Robust standard errors in parentheses. *Significant at 1%; **Significant at 5%; ***Significant at 10%. In model (1), α varies by time period and state; in model (2), α varies by time period, state, and life expectancy. We exclude all observations where the internal rate of return exceeds 0.4 or life expectancy exceeds 100 months. All estimates statistically significant at the 1% confidence level.

largest percent decline in the number of firms between 1996 and 2001, also had the largest increase in $\alpha_{\tau s}$ over that time period.

In our second specification, which permits α to differ for patients with low and high life expectancy, we find similar results for the subset of consumers with a life expectancy of one year or less. That is, the estimates suggest an increase in the market power of firms in the 1999 to 2001 time period, which is most likely related to the significant firm exit in the preceding time period.

For those with life expectancy greater than one year, $\alpha_{s\tau LE}$ increases steadily across the three periods for all states except Oregon (which may be a result of its small sample size, $n = 45$). We also find that for those with with less than one year to live, $\alpha_{s\tau LE}$ is larger than the corresponding value of α for those with longer life expectancy, although in later years the difference in αs is statistically insignificant (see the last column of the table).

We conjecture that the reason sicker HIV patients face higher price-cost margins is that the search costs associated with choosing the most generous viatical contract and the willingness to sell are highest for individuals with an imminent risk of death. Thus, out of desperation and a high preference for immediate consumption, these individuals may be more likely to accept prices which deviate from marginal costs.

In combination, the estimates for δ_τ and α suggest that both changes in optimism about treatment advances and changes in market power and costs have contributed to the diminishing nominal settlement prices over the last decade which we observed in section 2.3. Changes in mortality expectations appear to have had the most significant impact on prices between the pre- and post-HAART periods, as our results show that δ_τ had risen while α declined over this interval. By contrast, it appears that viatical firms' market power have contributed most substantially to declining settlement prices between the most recent two periods—likely as a consequence of significant firm exit.

6 Conclusion

Viatical settlements, and similar types of transactions, have the potential to be an important financial resource for the terminally ill and the elderly. The availability of these instruments may reduce the dependence of these vulnerable populations on public assistance and need-based programs. Viatical settlements may also affect the use of health care services by providing financial resources to the underinsured or uninsured populations. They may help finance new and experimental treatments not covered by conventional health plans or long term care for the chronically ill. While it is unlikely that the demand for viatical settlements by individuals with HIV has diminished in recent years—as treatment costs continue to soar—the availability of suppliers for these contracts has declined. Many firms are not willing to accept new contracts and are exiting the market. Moreover, policyholders face diminishing prices, even holding life expectancy fixed.

In this market, lower prices within life expectancy classes are typically seen as worse for policy holders, but the cause of the lower prices has important implications for whether there exists a policy issue. If lower settlement offers are due to high expectations about new discoveries, consumers receive a fair economic price for their life insurance policy even at the lower prices. In that case, the market is simply using new information about the treatment horizon to more accurately predict policyholders' mortality profiles, and no welfare loss ensues. On the other hand, lower settlement offers that result from reduced competition obviously diminish consumer welfare. Our empirical results suggest that changes in mortality expectations drove the decline in settlement prices during the middle part of the last decade, that is, the period when new treatments for HIV diffused rapidly. However, high levels of market power may be responsible for lowering returns during the latter half.

How much did the increase in market power of viatical firms in the Resistance era (1999 - 2001) hurt consumers? The answer to this clearly depends on how many HIV+ and other terminally ill consumers own life insurance and the total value of their life insurance holdings. Data from the HIV Costs and Services Utilization Study (HCSUS)– a nationally representative panel study of HIV+ persons – provide reliable estimates of the life insurance holdings of HIV+ persons. The HCSUS data represent 231,400 HIV+ adults who received care for HIV in 1996. Of these, an estimated 80,575 adults had life insurance policies in force in 1998. The average face value of their life insurance policies was $83,859, so the total face value of the life insurance holdings of HIV+ persons in 1998 was about $6.8 billion. We estimate that the increase in market power in the Resitance era reduced prices by roughly 15 cents per dollar of face value (see Table 7). Thus, our estimates imply that the increase in market power of firms reduced the value of life insurance holdings of HIV+ persons by about 1.0 billion dollars. This is a significant welfare loss for these terminally ill consumers both in absolute and relative terms and equals about a quarter of the value of their non-life insurance assets.[10]

Still, these results do not necessarily motivate price regulation. Price floors, like those which have already been implemented in several states, may actually prevent trades which are mutually beneficial to the consumer and viatical firm (see Bhattacharya et al., 2004). This may be especially true during a period in which market expectations of treatment effects and future treatment breakthroughs are in a constant state of flux (large δ). Consider, for example, the effects of a hypothetical minimum price floor enacted prior to the introduction of HAART. Since there is strong evidence that changes in risk premiums drove the reduction in settlement prices between 1995 and 1996-1998, a minimum price floor would have made it difficult for many AIDS patients to sell their policies during this period even though it may have otherwise been appropriate to do so. Moreover, consumers with AIDS

[10]This estimate is also based on HCSUS data which show that HIV+ persons with life insurance polices had a mean net worth (excluding life insurance) of $63,809.

may possess unique characteristics with respect to their income levels, marriage status, and bequest motives which have a differential influence on their willingness to sell their policies relative to other types of consumers. In particular, previous work has shown that low bequest motives and low income intensify the magnitude of welfare loss from inappropriately blocked transactions (Bhattacharya et al., 2004). Stringent minimum price regulation is unlikely to take into account these types of complexities when determining threshold price levels.

More broadly, the story of the viatical settlement industry in the late 1990s suggests that even dying industries may greatly enhance the welfare of market participants. Certainly, those who sold policies at near actuarially fair prices in the pre-HAART and post-HAART periods benefited from the ability to liquidate their life insurance equity. However, even those who sold policies in the late 1990s, when the market had become non-competitive, benefited relative to not having been able to viaticate at all—an oligopsony is better than no market. The introduction of viatical settlement contracts in 1989 was an important advance in the technology of contracting. It is ironic that the dissemination of HAART in 1996, a technological advance that greatly enhanced the welfare of HIV patients, mitigated the welfare enhancing effects of the earlier economic innovation.

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Appendix

Taking advantage of states financial filing requirements, we have put together the first systematic dataset detailing information on actual viatical transactions in the U.S. At present, roughly half of all states regulate viatical settlement markets. In nearly all of these states, viatical firms must be licensed, and they must file annual statements regarding all of their transactions in that state. Some states, such as California, New York, and Oregon, require firms to file reports about transactions from all states where they do business. Typically firms are required to disclose the following detailed descriptions of each viatical settlement contract in their annual reports: face value of policy sold; settlement amount received; life expectancy of the seller at time of sale; type of terminal illness; date of transaction; premium paid; and, type of policy.

Under the Freedom of Information Act (FOIA),[11] we requested the annual reports of all viatical firms for the period between 1995 and 2001 (the most recent years available at the start of this analysis). We have a complete set of reports from seven states - California, Connecticut, Kentucky, North Carolina, New York, Oregon, and Texas. The data were entered and cleaned by deleting transactions with nonsensical values (e.g. negative life expectancy, or settlement amount greater than face amount) and with missing values for critical variables. The data were then aggregated in a way that prevented the duplication of records in the combined dataset: we started with the state with the largest number of nationwide transactions reported (CA) and then added any transactions by companies licensed in the second-largest state (NY) that were not already accounted for in the California data, and so forth. Ultimately, we were able to include records that were not reported in the actual state in which they were transacted. For example, sequentially adding New York and Oregon's data to California retrieved nearly 1,000 additional transactions in California, which were undocumented in the reports we received from California alone.

One problem with many of the annual reports was that the information about premium payments on the original life insurance policy were included

[11] "The Freedom of Information Act (F.O.I.A.) U.S.C. (United States Code) Sec. 552 was enacted in 1966 so that any individual or organization would have access to certain government records. For more detail, see http://www.ftc.gov/foia/index.htm.

in a separate table that often could not be linked to the transaction data by a unique policy identifier. In a few cases, no premium information was available at all. To address this problem, we matched a number of records in both tables using combinations of the following fields: settlement amount, face amount, life expectancy, and purchase date. We used California annual reports from 1998-2001 to extract a representative 11 percent sample of premiums (n=1,287). This method captured records from all years and nearly all states, since, in each year's report, California requires its viatical firms to report all of their transactions from all U.S. states, for the current year as well as from previous years. We then calculated the premium per month as a percent of face amount for the California sample and ran a multivariate regression controlling for face amount, life expectancy, and purchase date in order to impute the missing premium percentage for the remaining transactions in the dataset.

We close this appendix with two caveates about our dataset. First, while the dataset represents a comprehensive set of transaction data for firms operating in licensed states, it is not nationally represenative. Our data includes a sample of transactions from every unregulated state (since viatical firms conduct business in both regulated and unregulated states), but there may be other firms operating in only unregulated states whose transactions we will never observe. Second, our data are specific to viatical settlement transactions; we have almost no information on life settlements. These financial vehicles, though similar to viatical settlements, differ in that they are marketed to elderly who are not terminally ill. State viatical regulations have mostly been applied to only terminally or chronically ill individuals and thus, life settlements have not been subject to the same filing requirements.[12]

[12]The National Association of Insurance Commissioners (NAIC) adopted a model law in 2001 to broaden the definition of contracts covered under viatical regulations to include all contracts (such as life settlements) that exchanged life insurance policies for less than their expected death benefit (NAIC, 2004).