Reputation, Price, and Death: An Empirical Analysis of Art Price Formation

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CESIFO WORKING PAPER NO. 2237
CATEGORY 9: INDUSTRIAL ORGANISATION
MARCH 2008

CESifo *Working Paper No. 2237*

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Abstract

We analyze how an artist's death influences the market prices of her works of art. Death has two opposing effects on art prices. By irrevocably restricting the artist's oeuvre, prices, ceteris paribus, increase when the artist dies. On the other hand, an untimely death may well frustrate the collectors' hopes of owning artwork that will, as the artist's career progresses, become generally known and appreciated. By frustrating expected future name recognition, death impacts negatively on art prices. In conjunction, these two channels of influence give rise to a hump-shaped relationship between age at death and death-induced price changes. Using transactions from fine art auctions, we show that the empirically identified death effects indeed conform to our theoretical predictions. We derive our results from hedonic art price regressions, making use of a data set which exceeds the sample size of traditional studies in cultural economics by an order of magnitude.

JEL Code: Z11, J24, G12.

Keywords: art price formation, death effect, durable goods monopoly.

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29 January 2008
We thank Günther Schulze for helpful comments.

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1. Introduction

Art prices are often claimed to substantially increase when the artist dies. These claims appear to be largely based on anecdotal evidence. They are promulgated by hearsay and sometimes cleverly insinuated by art dealers who attempt to convince naïve customers that it is justified to mark up the artwork of recently deceased artists. This study provides a theory-guided empirical analysis of the so-called "death effect" on art prices. The analysis employs hedonic price regressions and makes use of a dataset which exceeds the sample size of traditional studies in cultural economics by an order of magnitude, thereby shedding a new light on previous investigations of art price formation.

Even though the literature on art auctions, art price indices, and rates of return in the visual arts market is by now quite voluminous (see, repectively, Ashenfelter and Graddy, 2006, Ginsburgh, Mei and Moses, 2006, and Frey and Eichenberger, 1995), the death effect has not received much attention so far. To be sure, there are a few empirical studies which allow for a death effect, but these studies do so in a rather cursory and off-handed manner by merely including in their regressions a dummy variable that distinguishes between works of art created by living and late artists (see, for example, Agnello, 2002, and Worthington and Higgs, 2006).

The first investigation that has squarely addressed death-induced art price changes is Ekelund, Ressler and Watson (2000). These authors go some way in providing a theoretical underpinning of the death effect by pointing out that artists produce durable goods under market conditions of monopolistic competition. Thus, given rational actors in the art market, the *Coase Conjecture* applies (Coase, 1972): even though artists have, in principle, some discretion in setting prices, they cannot exert market power because they are unable to credibly commit to not lowering their prices in the future by spoiling the market with an inflationary increase in production. During an artist's lifetime, prices will therefore settle well below the monopoly price. Death, of course, is the ultimate device to commit to discontinuing production. Art prices thus increase when the artist dies because her oeuvre all of a sudden becomes scarcer than originally anticipated. After having laid this theoretical foundation, Ekelund, Ressler and Watson proceed to empirically identify the death effect with the help of a hedonic price regression. Their data consists of a panel of auction records relating to the work of 21 Latin American artists who died near or during the observation period (1977-1996). The prices are shown to peak in the years immediately following an artist's death, thus lending support to the existence of a death effect.

From a theoretical point of view, the main concern with this pioneering analysis relates to the artists' age at death. Since the probability of dying increases with age, the information of an old artist's death is not very surprising and should therefore already be largely reflected in the price, implying a small death effect. The death of an old artist, moreover, causes a relatively small reduction in the anticipated size of her oeuvre which, again, translates into a relatively small price increase when her death is made public. Assuming rational expectations, one would therefore expect the death effect to decrease with the artist's age at death. A formal rendering of this argument is to be found in Itaya and Ursprung (2008) who investigate the death effect in an infinite-horizon dynamic general equilibrium setting. It therefore stands to reason that the death effect depends on the age at death. Neglecting this relationship in empirical investigations may, of course, give rise to a seriously misspecified econometric model.

A recent study by Maddison and Jul-Perdersen (2007) acknowledges that the prices of an artist's works should depend on the expected total supply which, in turn, depends on the artist's conditional life expectancy at the time of sale. Using a data set comprising auction prices of oil paintings by Danish artists who died during the period 1983-2003, Maddison and Jul-Perdersen show that the variable "conditional life expectancy" (which, by definition, assumes the value of zero for artists who are not alive anymore at the time of sale) has a significant negative effect on art prices in their hedonic fixed-effects panel regression, while the dummy variable indicating whether the artist was dead or alive at the time of sale does not appear to have an independent significant influence. These results are compatible with a positive death effect that decreases with the age at death.

Our empirical strategy is to identify the relationship between the death effect and the artists' age at death more directly. We also employ hedonic fixed-effect panel regressions which however include a polynomial of the age at death to explain the prices of those pieces of art whose creators have died shortly before the respective transaction has taken place. Our dataset comprises a selection of 436,308 transactions extracted from *Hislop's Art Sale Index* (1980-2005). It is thus much larger than the datasets used so far in empirical studies of art price formation.[1] In any event, it is sufficiently large to estimate the influence of low-impact determinants even for relatively small price segments of the art market with the help of quantile regressions.

Our empirical analysis is guided by theoretical considerations. Since reputation plays a major role in the arts market (cf. Beckert and Rössel, 2004), we analyze a durable goods monopoly model which encompasses reputation-induced demand. Our main result shows that the relationship between the death effect and the artists' age at death is inversely u-shaped: the death of young artists actually decreases the price of their works of art, whereas the death effect is positive for older artists and disappears for artist's who die at a very old age. This pattern perfectly matches our predictions. The *negative* price effect of untimely deaths, which has not been considered in the literature so far, is a straight forward consequence of reputation-induced demand for works of fine art. The basic mechanism works as follows. At the beginning of their careers, artists have no far-reaching reputation to speak of. Nevertheless, collectors who happen to be familiar with the work of promising young

[1] To provide a reference point, we report here the number of observations of the studies cited above: 630 (Ekelund et al., 2000), 4857 (Maddison and Jul-Pederssen, 2007), 25,217 (Agnello, 2002), and 30,227 (Worthington and Higgs, 2006).

artists might well pay a considerable price for their works of art since they expect these artists to eventually obtain a reputation that justifies the price they pay for the fledgling's work. If such an artist dies an untimely death, her lifetime oeuvre might not be sufficiently substantial to generate the expected reputation, and the price drops. There are thus two mechanisms determining the death effect: the standard positive effect deriving from unexpected scarcity of supply and a negative effect deriving from frustrated demand-side expectations of artistic reputation. Both effects disappear for artist's who die at a ripe old age. In conjunction, the scarcity and the reputation effect give rise to the identified inversely u-shaped relationship between death-related price changes and age at death.

In deriving this relationship, we follow a minimalist modelling strategy, i.e. we only portray those stylized facts of the art market that are absolutely necessary to arrive at the empirically identified price pattern. In particular, we do not replicate the approach employed by Itaya and Ursprung (2008) who derive optimal consumption and production paths for the collectors and artists, albeit without considering reputation-induced utility on the part of the collectors. We rather proceed directly from a postulated market demand function and assume that the artists' flow production is constant over career time and homogenous. This portrait of the production process is admittedly quite stark: the optimal production path derived in the study by Itaya and Ursprung (2008) suggests, for example, that production declines over an artist's career time, and various empirical studies indicate that some artists' early work is most highly appreciated, whereas others produce their most successful work at a more mature age (see, for example, Galenson and Weinberg, 2000 and 2001, and Edwards, 2004). All of these idiosyncrasies of artistic production do however not affect the qualitative conclusions of our main argument. To minimize nomenclature, we therefore chose to associate an artist's stock of finished works of art with his or her career age by assuming a constant flow production of homogenous works of art. We also assume an efficient arts market which presupposes well functioning institutions. Again, in an attempt to arrive at a minimalist model, we chose not to portray the respective institutional details. We simply assume that the established modern gallery system, as it developed after WWII, is able to match the collectors' demand with the supply in a frictionless manner.

The paper unfolds as follows. Our minimalist model is developed in Section 2. In Section 3 we present the empirical methodology and our dataset. The estimates with respect to the variables that have traditionally been used in hedonic art price regressions are discussed in Section 4. In Section 5 we turn to our estimates of the death effect. We first show OLS estimates based on our full sample of auction records. In a second step, we then reduce the sample size in order to be able to estimate quantile regressions which serve, on the one hand, as a robustness test of our OLS estimates. On the other hand, these quantile regressions also shed some new light on art price formation in the middle and high-end segment of the art market. Section 6 concludes.

2. A minimalist model

Consider the oeuvre of a deceased artist. The price of her artwork varies positively with the quality as perceived by the contemporary collectors and, according to the law of demand, with scarcity. We capture these determinants with a standard downward-sloping demand function D(X), where X denotes the size of the artist's lifetime oeuvre. The art price also depends on the artist's reputation. To gain a reputation in the global art scene, an artist's work needs to be well known to a large audience which implies that reputation, ceteris paribus, increases with the size X of the oeuvre.[2] Let the increasing function R(X) describe the impact of reputation on the art price and let the "estate" price be defined as $P_e(X) = D(X) + R(X)$. It can safely be assumed that the reputation effect R(X) dominates the scarcity effect D(X) for sufficiently small oeuvres, implying that $P_e(X)$ is initially increasing in X. For large lifetime D(X) oeuvres X, the scarcity effect may take over to give rise to a single peaked demand function.

The following specification serves as an illustration. Let D(X)=a-bX, and R(X)=rX for $X<\hat{X}$ and R(X)=r$\hat{X}$ for $X\geq\hat{X}$, where r>b. We thus assume that reputation increases with X as long as the oeuvre X falls short of the critical size $\hat{X}$. The parameters a, b and r capture the quality of the artist's work, the price-sensitivity of scarcity, and the price-sensitivity of reputation. The resulting estate price equation has the following appearance:

$$\text{(1)} \qquad P_e(X) = \begin{cases} a-(b-r)X, \text{ for } X<\hat{X} \\ a+r\hat{X}-bX, \text{ for } X\geq\hat{X} \end{cases}$$

In order to determine the price of the works of art of a living artist, we assume that the collectors are perfectly rational and risk neutral; to be more precise, they are at each point of time willing to pay a price that is consistent with the price that is expected to prevail in the long run when (as the art lover John Maynard Keynes pointed out in a different context) the artist will be dead and the estate price as given in equation (1) applies. In period (year) t, a living artist's work thus commands the price

$$\text{(2)} \qquad P(t) = m_t P_e(\sum_{k=\underline{t}}^{t} x_k) + (1-m_t)m_{t+1}P_e(\sum_{k=\underline{t}}^{t+1} x_k) + (1-m_t)(1-m_{t+1})m_{t+2}P_e(\sum_{k=\underline{t}}^{t+2} x_k) + \ldots$$

$$= \sum_{k=t}^{\overline{t}} \left[m_k \left\langle \prod_{s=t}^{k-1}(1-m_s) \right\rangle P_e\left(\sum_{j=\underline{t}}^{k} x_j \right) \right],$$

where m_k denotes the mortality rate, i.e. the probability of dying at the end of year k, and x_k the artistic output in year k. In the simplest possible model of artistic production, output is constant over career time, i.e. x_k=1 for $\underline{t}\leq k\leq\overline{t}$ and x_k=0 otherwise, where $\underline{t}$ marks the beginning of the artist's career, $\overline{t}$

[2] The assumption that reputation varies positively with the size of the oeuvre, or, alternatively, with career age, is supported by the empirical evidence provided by Beckert and Rössel (2004).

the retirement age, and output is normalized to unity. Assuming constant production has the advantage that the artist's oeuvre $\sum_{k=\underline{t}}^{t} x_k$ can be expressed by her (career) age.

Using a numerical specification of the estate price equation (1) and mortality rates from a real world life table, the period art prices P(t) can easily be computed from equation (2).[3] We assume in our example that the artists' careers begin at age $\underline{t} = 20$, that they retire at age $\overline{t} = 89$ (the last age for which reliable mortality rates are available), and that reputation reaches the maximum level after 50 years of productive life (i.e. $\hat{X} = 50$, or, alternatively, $\hat{t}$ =70). Furthermore, we assume a=10, b=0.1 and r=0.2. The resulting period prices P(t) are depiced in the first panel of Figure 1 together with the estate prices $P_e(t)$, where $P_e(t)$ is the price that prevails after the artist's death at age t. The second panel depicts the death effect Δ(t), expressed as the percentage change in the art price if the artist dies at age t: $\Delta(t)=[P_e(t)-P(t)]/P(t)$.

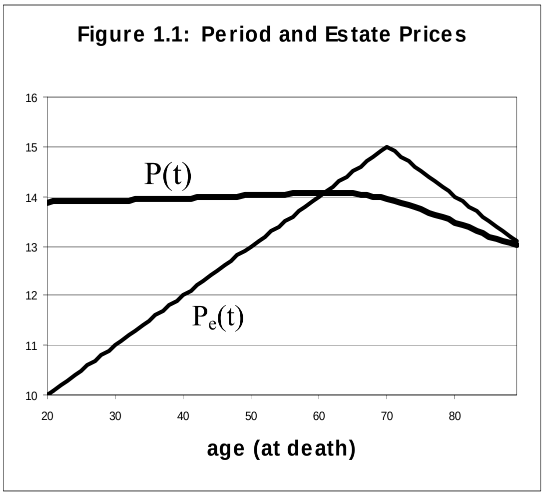


Figure 1.1: Period and Estate Prices

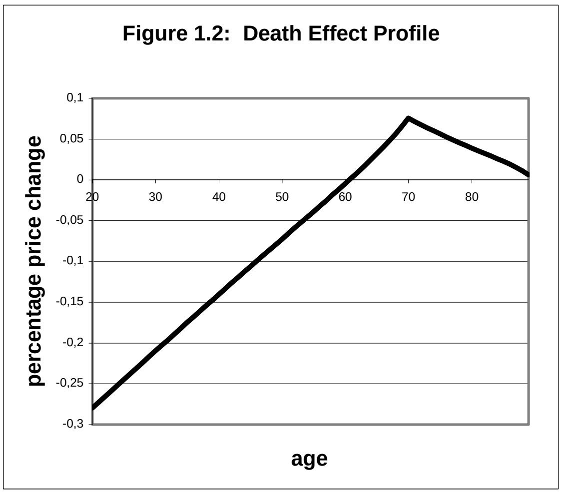
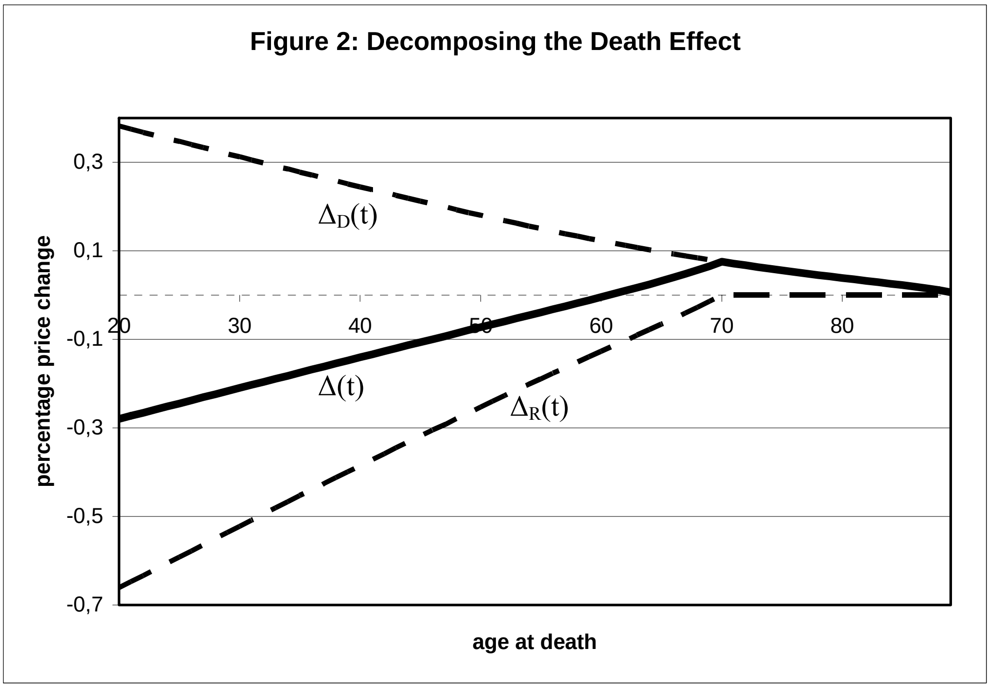


Figure 1.2: Death Effect Profile

In our example the death effect is negative for artists who die before they reach the age of 60, and it is positive for artists who die at a greater age. Using the additive structure of our price equation (1), the death effect can easily be decomposed into its two component parts, the reputation effect and the scarcity effect. If art prices were exclusively determined via expected reputation, i.e. if $P_e(X)=R(X)$, the death effect $\Delta_R(t)$ would be negative and decreasing (in absolute values) up to the critical age at which the artist's reputation reaches the maximum level (in our example at the age of 70). If the artist dies at a greater age, no reputation-related death effect occurs (see Figure 2). On the other hand, if reputation played no role and art prices depended only on expected scarcity, i.e. if $P_e(X)=D(X)$, the death effect $\Delta_D(t)$ would be positive and decreasing up to the age at which the artist stops producing

[3] We used the period life tables published by the German Office for Statistics. The mortality rates apply to males in the years 1992/94 which mark the middle of our observation period. See http://www.sozialpolitik-aktuell.de/docs/Periodensterbetafeln.pdf

(in our example at 89). Adding up the reputation and scarcity-related death effects yields the total effect Δ(t).



We now turn to analyzing the relationship between the quality of an artist's work and the size of the death effect. To do so, we proceed from two straightforward assumptions concerning the two components of our estate price equation (1). We begin with the function D(X). Since the work of outstanding artists is, almost by definition, very special, these artists can truly be considered to produce under conditions of monopolistic competition. Less innovative artists, on the other hand, produce artwork that belongs to a specific genre, but is not distinguished by any idiosyncratic creative idea that sets it apart from the production of close competitors. These artists bear a resemblance to mere artisans who produce under market conditions of perfect competition. Prices for artwork created by top artists are thus not only higher than prices for works of art of lesser quality, price sensitivity is also larger. In terms of D(X) this means that the parameters *a* and *b* both vary positively with artistic quality.

The reputation-induced price component R(X) which portrays the influence of reputation depends on artistic quality as well. Reputation is, after all, directly related to an artist's ability to create truly original works of art. The more novel and ingenious an artist's work is, the more there is to be discovered, the more information about her work can be exchanged and transmitted by the key players and institutions that make up the global art market. It is evident that this reputation-generating mechanism can only properly work if the there is a sufficiently large oeuvre to be promulgated; this is why reputation increases as the artist's oeuvre grows. More important for gaining a sustainable reputation is, however, that the artist's work is sufficiently rich in scope to sustain an ongoing discovery process. In other words, the reputation-generating mechanism feeds on artistic quality. The extent to which an increase in the size of an artist's oeuvre X translates into a gain of reputation R, thus varies positively with the artist's ability to create outstanding works of art, i.e. $dR/dX \equiv r$ increases with artistic quality.

We sum up by concluding that the parameters a, b and r of our estate price equation (1) vary positively with artistic quality. Since the incline of the upward-sloping part of $P_e(X)$ depends on the difference b-r, it is not a priori clear whether better artists face steeper or flatter demand curves in the beginning of their careers than their less accomplished colleagues. This ambiguity is however due to our linear specification. A more realistic portrait would assume concave functions D(X) and R(X). Concavity would imply that changes in R(X) translate directly into changes of $P_e(X)$ for small values of X since the slope of D(X) is close to zero at X=0. We therefore assume that higher artistic quality gives rise to steeper demand curves as illustrated in the first panel of Figure 3.[4] The second panel of Figure 3 shows how these differences in artistic quality translate into percentage price changes when the artist dies. This panel also neatly summarizes the five hypotheses that are empirically tested in the remainder of this study.

Figure 3.1
Artistic Quality and Demand

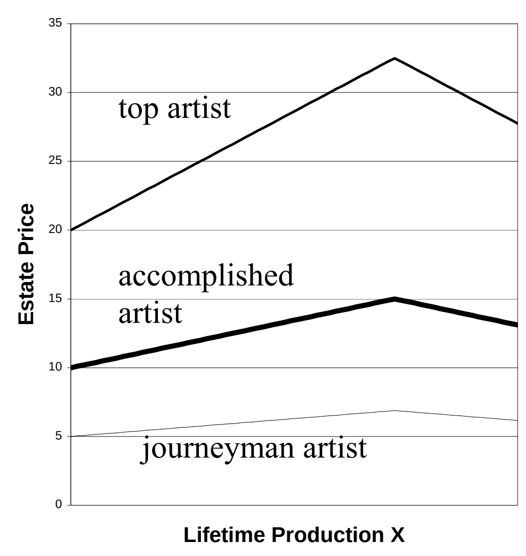
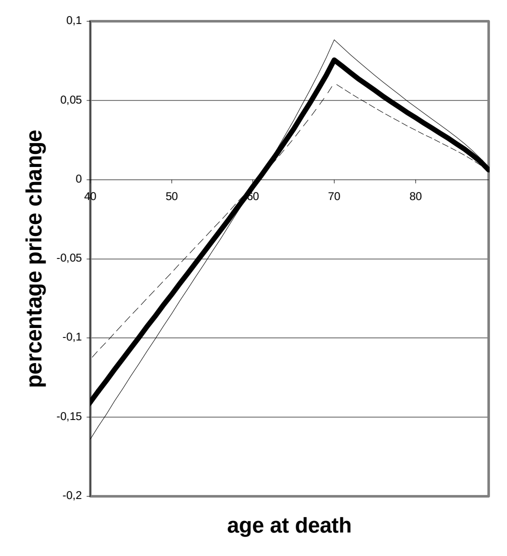


Figure 3.2
Death Effect and Artisic Quality



Hypothesis 1: The death effect is a statistically significant phenomenon.

Hypothesis 2: If an artist dies at a relatively young age, the price of her works of art decrease on impact; the price increases however on impact if the artist is lucky enough to live a full life. In other words, for artists dying at a young age, the death effect is dominated by the reputation effect, whereas for artists who die at an old age, the scarcity effect dominates.

[4] The bold curve which describes the demand faced by a representative accomplished artist is the one we have used above: $D_A(X)=10-0.1(t-20)$, $R_A(X)=0.2(t-20)$. Multiplying the intercept and the slopes by 2 (½) and then augmenting (diminishing) the absolute value of the slope by 25% yields the demand curve faced by top-artists (journeymen artists): $D_T(X)=20-0.25(t-20)$, $R_T(X)=0.5(t-20)$ and $D_J(X)=5-0.0375(t-20)$, $R_J(X)=0.075(t-20)$.

Hypothesis 3: The relationship between the death effect and the age at death is inversely U-shaped.

Hypothesis 4: The absolute values of the death-induced price changes vary positively with the quality of the deceased artist's work. Since high artistic quality – which we cannot directly observe - gives rise to high prices, this hypothesis implies that the death effect is, ceteris paribus, largest (in absolute values) for artwork fetching high prices.

In focussing our model on the death effect we did not mean to imply that this effect represents a foremost determinant of art price formation. We focussed on the death effect simply because it has hitherto been neglected in the relevant literature, and we readily acknowledge that we are dealing here with a very particular phenomenon by adding

Hypothesis 5: Art prices are determined by many factors. Even though one of the most important determinants, artistic quality, is hard to quantify if resorting to the market price is ruled out, many observable factors such as size, medium, genre, time of sale, etc. do have a significant and systematic influence on art price formation.

3. Methodology and Dataset

We test the hypotheses derived in the previous section with the help of hedonic price regressions of the following type:

$$\text{(3)} \qquad \ln p_{it} = \alpha + \sum_{l=1}^{m} \beta_l x_{il} + \sum_{r=1}^{s} \gamma_r y_{itr} + \delta_j + \theta_t + \varepsilon_{ijt} \, ,$$

where p_{it} is the real price of artwork i (in 1982 US dollars) sold at time t. The art price is determined by a constant, time-invariant idiosyncratic characteristics x_{il} [size, medium, etc.], time-varying characteristics y_{itr} [auction house, the flow-supply of the artist's work in a particular year, the artist's state of being alive or dead etc.], artist dummies δ_j [Picasso, Pollock, Warhol, etc.] capturing the artists' abilities and reputation, and time dummies θ_t which allow to estimate the influence of the overall art price movement on the price of a specific work of art. These time dummies can also be used to construct a price index for a standardized piece of art. Given the semi-logarithmic specification of our estimation equation (3), the interpretation of the estimated coefficients is straight forward. Percentage changes in the estimated price, given a unit change in, for example, an explanatory variable x_ℓ, can be calculated as $\Delta p = \exp(\hat{\beta}_\ell) - 1$.[5]

The time-dependent variables are of crucial importance for a study investigating the dynamics of art price formation. A first set of time-dependent variables refer to the time when the artwork was created. The date of creation is important because it contains some information about the artwork's genre and

[5] This transformation applies since all of our explanatory variables assume discrete values. For continuous variables, the percentage change in the price would be directly reflected by the estimated coefficient.

style which might or might not agree with the contemporary collectors' tastes. Decade dummies seem to be appropriate to capture the style and genre of an artwork. A second set of time-dependent variables is needed to portray the general economic condition and the art market environment at the time of the auction. The boom in the art market in the early 1990 has, for example, been attributed to the bullish stock markets in Japan during that time. We control for changes in the macroeconomic conditions by including "year of sale" variables. A third time-dependent variable that on might want to include is the artist's age at the time of sale or, if the artist is not alive anymore, the length of her life, which, according to our model, can serve as a proxy for the artist's reputation as well as for the scarcity of her oeuvre. Since we include artist-specific dummies, the influence of the length of (productive) life cannot be independently estimated for late artists. For artists who are still alive or have died during our observation period (1980-2005), the *age at the time of sale* can in principle be included as an explaining variable, at least for those artists whose work has be sold repeatedly during our observation period. Since, however, the maximum time span of 26 years is rather short, we have decided not to use this variable in our preferred specification of the regression. We have, however, run regressions with the artists' age at the time of sale as an explanatory variable. Including this variable has no perceptible influence on our estimates.

It has been argued that an artist's *age at the time of creation* is related to artistic quality (see Galenson and Weinberg, 2000 and 2001, and Edwards, 2004). One may therefore think that this age should also be included in the regression as an explaining variable. Since, however, the life-cycle creativity patterns are quite diverse, one cannot estimate a common pattern; and classifying hundreds of artists according to whether they have bloomed early in their careers or late, does not appear to be a viable empirical strategy.[6]

To identify the death effect, we make the following distinction:

i. Living artists: if a piece of art created by a living artist is sold, the mean price for her works of art is picked up by the artist's dummy variable δ_j.

ii. Recently deceased artists: if a piece of art created by a recently deceased artist is sold, the price incorporates the death effect. To capture the death effect, we introduce the 0-1 dummy variable *Death*, which equals unity if the recently deceased artist's work is sold either in year T in which the artist died, in year T+1, or in year T+2. We have chosen this rather broad time span for two reasons: First, we don't know in which month an artist died. If an artist dies after the fall auctions, the death effect can only be noticed in the following year. Moreover, works of art of some artists are not auctioned each year. To be on the safe side we therefore allow for an additional year for the death effect to be noticed at an auction. Since our theory predicts the death effect to depend on the artists age at death we interact the *Death* variable with the variable *Dage* (age at death = death year – birth year) to arrive at

[6] Galenson's claim that the life-cycle creativity patterns depend on the artist's production technique has been controversially discussed in the literature (see, for example, Ginsburgh and Weyers, 2006).

the crucial variable *D-Dage*. By estimating polynomials of *D-Dage* of degree three, four and five we are able to identify the sought-after death-effect profiles.

iii. Deceased artists: We control for the evolution of prices beyond the year T+2 by including the explanatory variable TSD which measures the time passed since the artist died. TSD is zero up to T+2. The smallest positive value TSD can assume is thus 3. This specification assumes that prices evolve in a linear manner for a substantial time after an artist's death. We expect TSD to have a negative influence on prices since dead artists are no longer able to accommodate to the collectors' ever changing tastes.

Before turning to the estimation results, some comments on the employed estimation techniques are called for. We estimate equation (3) by OLS and quantile regressions. The reason for using these two approaches is the following. On the one hand, OLS is computationally less burdensome, which is - given the size of our dataset - clearly an advantage. On the other hand, OLS regressions are vulnerable to outliers, which is a severe drawback since art prices are very heterogeneous. Quantile regressions (cf. Koenker and Bassett, 1978, and Koenker and Hallock, 2000) are less likely to be influenced by extreme outliers since this method minimizes absolute deviations instead of squared deviations. Further advantages of quantile regressions include that they are likely to be more efficient in cases of heteroscedastic data and that one obtains a more differentiated picture of the analyzed price mechanisms.

Our "full" dataset is a selection from *Hislop's Art Sales Index* (CD-ROM 2005). This database contains art prices for oil paintings, works on paper, prints, sculptures, miniatures and photographs, all collected worldwide from public auctions between 1980 and 2005. From this sample we extracted a sub-sample of 436,308 transaction records for our OLS regressions. We applied five selection criteria: (1) the artwork is a print, a work on paper, or an oil painting; (2) the artwork was sold in the US, Japan, or Western Europe; (3) the birth year and, in case of a deceased artist, the death year are known; (4) the year of creation of the artwork is after 1873 and known;[7] (5) height and width of the artwork are known.

Computational limitations forced us to further restrict the sample size for our quantile regressions. To arrive at a manageable sample size we deleted all minor artists, defined as those artists whose works of art were auctioned less than 250 times in the sample period 1980-2005. Applying this admittedly arbitrary rule significantly reduces the number of artist from 25,204 to 262 [thus reducing the number of artist dummies], while preserving a relatively large number of observations (146,575).

A detailed description of the employed variables and summary statistics for both datasets are reported in the Appendix.

[7] This year was chosen since it roughly marks the beginning of impressionism.

4. First results

In Table 1 we report the results of three OLS regressions of equation (3). The death effect is estimated by a third-order polynomial of the variable D-Dage. Estimates of higher-order polynomials are discussed below. The first column reports the results using our full data set. Since our auction records cover the period 1980-2005, the estimated death effects relate to artists who died during this period. The second regression is based on a sub-sample of the full dataset which excludes works of art by artists who were already dead by 1980. The third regression only considers works of art by artists who died between 1980 and 2005.

Before elaborating on the estimated death effects in the following section, we discuss here the estimates of the other coefficients.

i. **Medium**: It is well known that different types of artwork fetch different prices. Our results confirm this. Oil on canvas yields the highest prices (+410% as compared to prints), followed by drawings on paper (+80%) and prints.

ii. **Size**: We allow for different size effects for oil paintings, drawings on paper, and prints. We make this distinction since large prints are an exception, whereas artists sometimes create extraordinary large paintings and drawings. Our estimates confirm our conjecture that size effects differ across the three media. For prints we find a stable linear relationship between size and price. An increase in height (width) by 10cm raises the price of a print by about 7.2% (3.9%). For oil paintings and drawings on paper, the estimates of the squared regressors become significant. Prices of “reasonably” sized pictures vary positively with size. As one would expect, prices do, however, decline beyond a critical size. This critical size appears to be determined by wall sizes in ordinary collectors’ homes. Paintings and drawings exceeding these dimensions are mainly bought by museums, whose demand is limited. To be more specific: prices of oil paintings increase up to a size of roughly 2.5×4m (height × width), but decline for larger dimensions. The same holds for works on paper whose optimal size in terms of revenue is 3.2 × 3.8m.

iii. **Signature**: A signature is a sign of authenticity. As expected, prices increase by roughly +27% if a work of art is signed. Our estimate is thus in line with the commonly held belief, but contradicts the finding by Czujack (1997) who cannot detect any positive influence of a signature on the price of Picasso’s works of art. We will return to this issue in the next section when we elaborate on the estimates of our quantile regressions.

Table 1: OLS regressions, 3rd-ordere polynomial of D-Dage

	full sample		year at death > 1979		2006 > year at death > 1979	
LNPRICE	coeff.	SE	coeff.	SE	coeff.	SE
Oil	1.6291***	0.013	1.6200***	0.019	1.6745***	0.025
OilHeight	1.1492***	0.013	1.0107***	0.015	0.9892***	0.021
OilHeightS	−0.2352***	0.004	−0.1859***	0.005	−0.1463***	0.006
OilWidth	0.8587***	0.010	0.8034***	0.012	0.8804***	0.018
OilWidthS	−0.1121***	0.002	−0.0999***	0.003	−0.1060***	0.004
Paper	0.5912***	0.012	0.7995***	0.019	0.7117***	0.024
PaperHeight	1.3041***	0.018	1.1532***	0.021	1.2826***	0.037
PaperHeightS	−0.2021***	0.006	−0.1621***	0.006	−0.1808***	0.014
PaperWidth	1.2625***	0.016	0.9817***	0.019	1.0548***	0.032
PaperWidthS	−0.1680***	0.004	−0.1088***	0.005	−0.0832***	0.009
PrintHeight	0.5445***	0.019	0.4751***	0.021	0.3669***	0.032
PrintWidth	0.3298***	0.017	0.3890***	0.018	0.2845***	0.026
Signature	0.1380***	0.005	0.0603***	0.007	0.1067***	0.009
Supply	−0.0004***	0.000	0.0007***	0.000	0.0006***	0.000
US	−0.1348***	0.010	−0.1407***	0.014	−0.1182***	0.019
JAP	0.2984***	0.107	−0.0190	0.130	0.0616	0.137
SOLO	0.4973***	0.006	0.4260***	0.009	0.3848***	0.012
SOPA	0.2839***	0.056	0.3279***	0.068	0.2557***	0.096
SONY	0.5808***	0.007	0.5120***	0.009	0.4919***	0.013
SOEU	0.1482***	0.008	0.1600***	0.011	0.1264***	0.015
SOUS	−0.0928***	0.017	−0.1019***	0.022	−0.1340***	0.032
CHLO	0.5851***	0.007	0.4663***	0.010	0.4837***	0.013
CHPA	0.1489***	0.042	0.1964***	0.052	0.1965***	0.071
CHNY	0.5339***	0.008	0.4983***	0.010	0.4685***	0.015
CHEU	0.0697***	0.007	0.0590***	0.009	0.0546***	0.013
CHUS	0.4080***	0.009	0.3485***	0.011	0.3766***	0.015
NY	0.0806***	0.011	0.0944**	0.016	0.0552**	0.022
LO	0.1759***	0.011	0.1401***	0.017	0.1463***	0.023
PA	0.0235***	0.006	−0.0054	0.007	−0.0155	0.010
ay1981	−0.0578***	0.014	−0.0659**	0.024	−0.0734**	0.031
ay1982	−0.1767***	0.015	−0.1881***	0.025	−0.2118***	0.033
ay1983	−0.0975***	0.015	−0.0997***	0.023	−0.0961***	0.031
ay1984	−0.0639***	0.014	−0.0906***	0.022	−0.0960***	0.029
ay1985	0.0668***	0.014	0.0351	0.021	0.0257	0.028
ay1986	0.3571***	0.014	0.3400***	0.021	0.3221***	0.028
ay1987	0.7531***	0.013	0.7281***	0.020	0.7155***	0.027
ay1988	1.0062***	0.013	0.9823***	0.020	0.9952***	0.026
ay1989	1.3287***	0.013	1.3681***	0.019	1.3579***	0.025
ay1990	1.4708***	0.013	1.5328***	0.019	1.5223***	0.025
ay1991	1.0701***	0.014	1.1064***	0.020	1.0888***	0.027
ay1992	0.9627***	0.014	0.9854***	0.020	0.9844***	0.027
ay1993	0.8182***	0.013	0.8304***	0.020	0.8434***	0.027
ay1994	0.8117***	0.013	0.8360***	0.019	0.8656***	0.026
ay1995	0.8692***	0.013	0.8534***	0.019	0.8832***	0.027
ay1996	0.8555***	0.013	0.8299***	0.019	0.8750***	0.026
ay1997	0.8434***	0.013	0.7994***	0.019	0.8409***	0.026
ay1998	0.9071***	0.014	0.8746***	0.019	0.9152***	0.027
ay1999	0.9357***	0.014	0.8998***	0.019	0.9453***	0.027

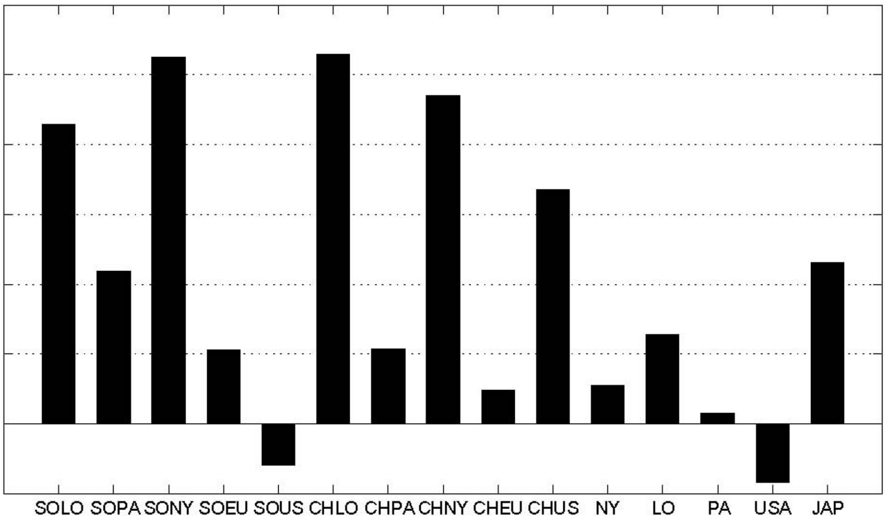
continued next page

LNPRICE	coeff.	SE	coeff.	SE	coeff.	SE
ay2000	0.9293***	0.014	0.8884***	0.019	0.9494***	0.027
ay2001	0.8911***	0.014	0.8669***	0.019	0.9385***	0.028
ay2002	0.9800***	0.014	0.9749***	0.019	1.0528***	0.029
ay2003	1.1274***	0.014	1.1346***	0.019	1.2146***	0.029
ay2004	1.2959***	0.015	1.3010***	0.019	1.3795***	0.030
ay2005	1.4383***	0.016	1.4923***	0.020	1.5687***	0.032
cdec1870	−0.1408**	0.067				
cdec1880	0.3680***	0.028				
cdec1890	0.3208***	0.024	0.3234	0.386	0.4578	0.406
cdec1900	0.3454***	0.022	0.4456***	0.096	0.6210***	0.128
cdecy1910	0.3627***	0.021	0.4029***	0.033	0.5378***	0.087
cdecy1920	0.2652***	0.021	0.2614***	0.023	0.4127***	0.084
cdec1930	0.1997***	0.021	0.2662***	0.021	0.4185***	0.083
cdec1940	0.1576***	0.021	0.2243***	0.020	0.3851***	0.083
cdec1950	0.0581***	0.021	0.1106***	0.019	0.2481***	0.083
cdec1960	−0.0568***	0.020	−0.0236	0.019	0.1026	0.083
cdec1970	−0.1591***	0.020	−0.1361***	0.019	0.0042	0.083
cdec1980	−0.1903***	0.020	−0.1544***	0.019	−0.0267	0.083
cdec1990	−0.1119***	0.020	−0.0899***	0.018	−0.0257	0.083
TSD	−0.0037***	0.000	−0.0119***	0.001	−0.0164***	0.001
D-Dage	−0.0277***	0.003	−0.0301***	0.003	−0.0325***	0.003
D-Dage2	0.6935***	0.088	0.7341***	0.082	0.7852***	0.085
D-Dage3	−0.0042***	0.001	−0.0044***	0.001	−0.0047***	0.001
Constant	4.9865***	0.026	4.8783***	0.032	4.9176***	0.089
Observations	436,308		213,528		109,659	
R^2	0.7594		0.7729		0.7624	
coefficients are significant on the 10% (*), 5% (**), and 1% (***) level.						

iv. **Supply**: One would expect the actual supply of an artist's work (as measured by the number of pieces auctioned in the respective year) to decrease the market price of her works of art. This expectation is based on the conviction that most collectors are merely interested in owning a representative piece of a certain artist rather than a specific piece. Our estimates indeed indicate that an additional supply of 10 pieces per year reduces the market price by about 0.5%. Although this effect is not very large, it indicates that an unusually large actual supply tends to depress prices, or, vice versa, higher prices are fetched in thin markets.

v. **Country of Sale and Auction House**: The influence of the country of sale and of specific salerooms is summarized in Figure 4.

Figure 4: Country of Sale and Auction House (full sample)



All percentage price changes reported in Figure 4 are with respect to a work of art sold in Europe, but not at Sotheby's or Christie's, and not in London or Paris. Sales at Sotheby's New York [+79%] yield higher prices than sales at Sotheby's London [+64%], Sotheby's Paris [+33%], and Sotheby's salerooms in the remaining Europe [+15%]. Sales at Sotheby's US excluding New York fetch even less [-9%]. Unlike Sotheby's, Christie's auctions achieve higher prices in London [+80%] than in New York [+71%], the rest of the US [+50%], Paris [+17%], and the remaining Europe [+7%]. Apart from the two predominant auction houses, we find that prices in London [+19%] are higher than in New York [+8%] and Paris [+2%], and sales in Japan [+35%] fetch more than sales in Europe and the United States [-13%].[8]

vi. **Price Index**: The hedonic art price index which results from the estimated coefficients of the year-dummies is depicted in the first panel of Figure 5. Our result is well in line with previous findings (see, for example, Ashenfelter and Graddy, 2006). In the year 2005 the art prices reached again the level of the last arts market boom in 1990. During the 1990's prices had been rather low and constant.

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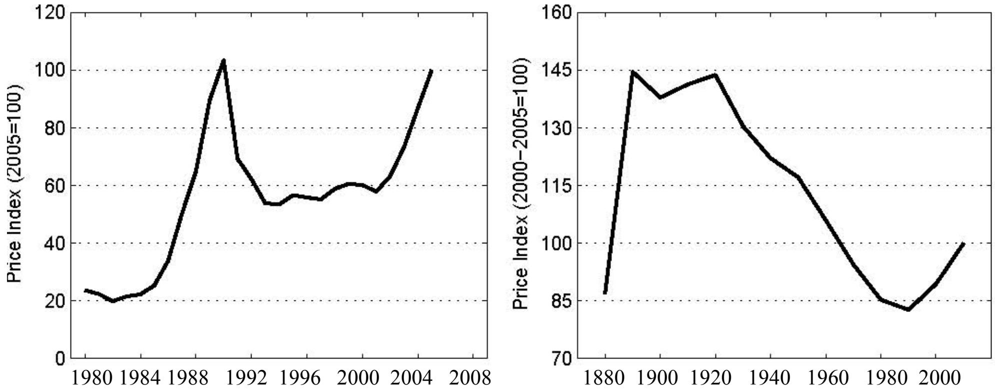
[8] These estimates reconfirm previous results indicating that the law of one price does not hold in the arts market (see, for example, Ashenfelter and Graddy, 2006, Pesando, 1993, Pesando and Shum, 1996, and Mei and Moses, 2002). Notice, however, that the estimated differences may be somewhat biased. Certain auction houses and salerooms appear to attracts works of art of superior quality, which increases the average price. Our regressions cannot completely control for this influence, because there are, for example, hardly any Picasso paintings sold at auction houses not located in Paris, London or New York. The high prices in Japan, moreover, seem to be driven, at least to some extent, by peculiarities in the data collection process. Japanese sales appear to be underrepresented in *Hislop's Art Sales Index* and the reported prices are extraordinarily high. We conjecture that the Japanese data may be incomplete with respect to the bottom of the distribution.

Figure 5: Hedonic Art Price Index, 1980 -2005, and Creation Period Index, sample 1



vii. **Genre**: The decade in which a work of art has been created is not merely an indicator of age but foremost an indicator of contemporary collectors' tastes for certain periods and genres. The estimated coefficients of the decade dummy variables thus reveal which periods were en vogue during our observation period (1980-2005). The results are summarized in the second panel of Figure 5. Works of art from the period 1890-1920 fetch the highest prices. Prices for works from subsequent periods vary positively with age; only the most recent batch appears to escape this rule, conceivably because contemporary artists are able to produce exactly that kind of art that meets the contemporary collectors' tastes.

All things considered, these results lend strong support to our Hypothesis 5. To be sure, this hypothesis is a For our quantile regressions simple restatement of the received wisdom. It is, however, worth mentioning again that we have confirmed these results with a dataset that is by an order of magnitude larger than the datasets that have hitherto been used in the relevant literature.

5. The Death-Effect

5.1 OLS Regressions

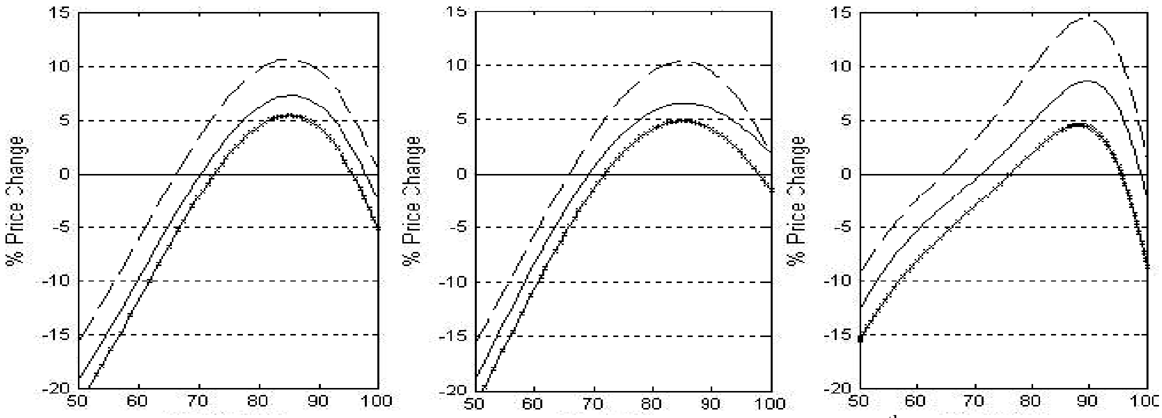
In this section we discuss the estimation results relating to our hypotheses on the death effect. We begin with the results of our OLS regressions. Table 2 reports the estimates of nine different OLS regressions. The first set of results corresponds to the estimates already shown in Table 1 (3rd-order polynomials of *D-Dage*). The estimates of the forth- and fifth-order polynomials of the variable *D-Dage* are taken from regressions using the same set of explaining variables.

Table 2:Comparison of different *D-Dage* polynomials (OLS)

LNPRICE	3rd-order polynomials		
	Full Sample	year at death > 1979	2006 > year at death > 1979
D-Dage	−0.0277101***	−0.0301143***	−0.0324680***
D-DageS	0.6934739***	0.7341452***	0.7851855***
D-DageT	−0.0041586***	−0.0043546***	−0.0046578***
Adj. R^2	0.7594	0.7729	0.7624
R^2	0.7446	0.7568	0.7534
Observations	436,308	213,528	109,659
	4th-order polynomials		
D-Dage	−0.0326757***	−0.0452921***	−0.0449829***
D-DageS	0.9146908**	1.4105710***	1.3427720***
D-DageT	−0.0073107	−0.0139974***	−0.0126044**
D-DageQ	0.0000145	0.0000444*	0.0000366
Adj. R^2	0.7594	0.7729	0.7624
R^2	0.7446	0.7568	0.7534
Observations	436,308	213,528	109,659
	5th-order polynomials		
D-Dage	−0.1065902***	−0.1223569***	−0.1191484***
D-DageS	5.7491710***	6.4534790***	6.1952460***
D-DageT	−0.1188100***	−0.1303223***	−0.1245290***
D-DageQ	0.0011069***	0.0011840***	0.0011330***
D-DageP	−0.0000039***	−0.0000040***	−0.0000039***
Adj. R^2	0.7594	0.7729	0.7624
R^2	0.7447	0.7568	0.7535
Observations	436,308	213,528	109,659
Coefficients are significant on the 10% (*), 5% (**) and 1% (***) level.			

It turns out that the results across all regressions are very similar and confirm the statistical significance of the death effect (Hypothesis 1). The fourth-order polynomial is, however, statistically somewhat less significant. The adjusted-R^2 statistics do not differ across the three different specifications which leaves us with a difficult choice with respect to the preferred specification. We also performed F-tests for the significance of the highest-order term of the polynomials. Even though the last terms D-DageP of the fifth-order polynomials is rather small, the F-tests nevertheless indicate that these coefficients are statistically different from zero. Since we do not have a preferred specification, we show in Figure 6 the respective plots for all nine regressions.

Figure 6: Death effect for different ages at death
(sample 1: dashed line, sample 2: solid line, sample 3: starred line)



3rd-order polynomial 4th-order polynomial 5th-order polynomial

All nine graphs have the same appearance: the relationship between the death effect and the age at death is inverted U-shaped, thereby confirming our third hypothesis. Also our second hypothesis passes the test with flying colours: the death effect is indeed negative if an artist dies at a young age. This negative impact decreases with increasing age at death, and the death effect completely disappears - depending on the specification - between the age of 63 and 75. If the artist dies after that critical age, the reputation effect is dominated by the scarcity effect and the death effect becomes positive. The death effect is at a maximum for an age at death between 83 and 88 years and amounts to 11%-14%. At greater ages at death, the effect appears to decrease again, and for some of the estimates we even obtain negative values. We do, however, not want to belabour this last point because borders of polynomials need to be interpreted with care, especially if they are determined by a rather small number of data points.

5.2 Quantile Regressions

We now turn to the quantile regressions which serve as a robustness check of our OLS results. Moreover, they allow us to test our Hypothesis 4. As already mentioned above, we need, for computational reasons, to restrict the analysis to a relatively small group of artists, and we do so by including only those artists whose artwork has been sold more than 250 times. We report only regressions using 3rd-order polynomials of the variable D-Dage since the OLS regressions have indicated that including higher-order polynomials has no notable effect on the estimates.[9]

[9] We have, however, checked the robustness of our results using both fourth- and fifth-order polynomials.

Table 3: Quantile Regressions, 3rd - order polynomials of *D-Dage*

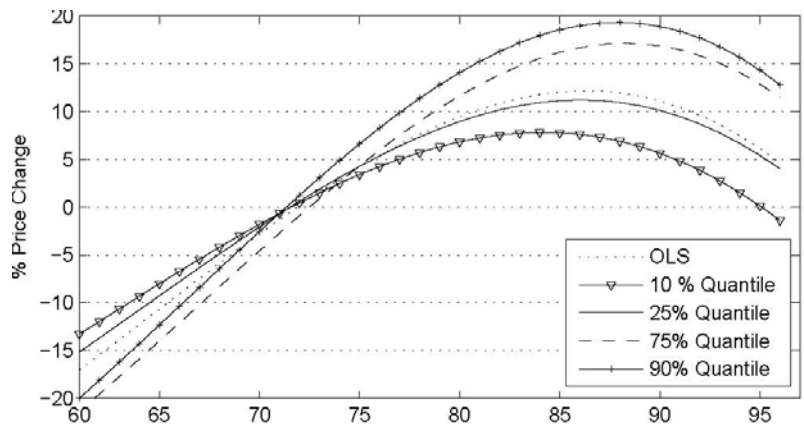
	10% Quantile		25% Quantile		75% Quantile		90% Quantile		OLS	
LNPRICE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Oil	0.9844***	0.03	1.4328***	0.02	1.9915***	0.02	2.0301***	0.04	1.7752***	0.018
OilHeight	1.6513***	0.03	1.7979***	0.03	2.0115***	0.04	2.0818***	0.07	1.7080***	0.028
OilHeightS	−0.4833***	0.01	−0.5142***	0.01	−0.5482***	0.02	−0.5437***	0.03	−0.4164***	0.010
OilWidth	1.0379***	0.03	1.0197***	0.02	0.8542***	0.03	0.7756***	0.04	0.8464***	0.020
OilWidthS	−0.1679***	0.00	−0.1612***	0.00	−0.1048***	0.01	−0.0770***	0.01	−0.1027***	0.004
Paper	−0.2069***	0.03	0.1784***	0.02	0.8229***	0.02	0.9194***	0.03	0.5098***	0.016
PaperHeight	1.5160***	0.04	1.7434***	0.03	1.8335***	0.04	1.8058***	0.08	1.5616***	0.030
PaperHeightS	−0.4024***	0.01	−0.4640***	0.01	−0.3880***	0.02	−0.3092***	0.04	−0.2723***	0.010
PaperWidth	1.9477***	0.04	1.9906***	0.03	1.6748***	0.04	1.5333***	0.06	1.7191***	0.030
PaperWidthS	−0.5198***	0.01	−0.5148***	0.01	−0.3221***	0.02	−0.2380***	0.03	−0.3331***	0.009
PrintHeight	0.3252***	0.05	0.4413***	0.03	0.5871***	0.03	0.6723***	0.04	0.5291***	0.024
PrintWidth	0.2120***	0.05	0.3885***	0.03	0.6717***	0.03	0.6614***	0.03	0.4053***	0.022
Signature	0.2516***	0.01	0.2391***	0.01	0.1628***	0.01	0.1064***	0.01	0.2289***	0.008
Supply	−0.0004***	0.00	−0.0005***	0.00	−0.0002***	0.00	−0.0001*	0.00	−0.0003***	0.000
US	−0.2607***	0.03	−0.2266***	0.02	−0.2546***	0.02	−0.2030***	0.03	−0.2605***	0.019
JAP	0.4300***	0.16	0.4625***	0.13	0.1275	0.15	−0.1477	0.18	0.2849**	0.117
SOLO	0.4191***	0.01	0.3789***	0.01	0.3264***	0.01	0.3390***	0.01	0.4283***	0.009
SOPA	0.1963*	0.12	0.2179*	0.09	−0.0441	0.11	−0.1856	0.13	0.1301	0.087
SONY	0.4439***	0.01	0.4305***	0.01	0.4447***	0.01	0.4747***	0.01	0.5295***	0.010
SOEU	0.1450***	0.02	0.0718***	0.02	0.1009***	0.02	0.0864***	0.02	0.0970***	0.015
SOUS	−0.1465***	0.04	−0.2003***	0.04	−0.2118***	0.04	−0.2564***	0.05	−0.2252***	0.032
CHLO	0.4825***	0.01	0.4436***	0.01	0.4145***	0.01	0.4301***	0.02	0.5299***	0.010
CHPA	0.1782*	0.09	0.1980***	0.07	0.0972	0.09	0.0966	0.10	0.1473**	0.068
CHNY	0.4608***	0.02	0.4304***	0.01	0.4276***	0.01	0.4405***	0.02	0.5255***	0.011
CHEU	0.0062	0.02	−0.0136	0.01	−0.0062	0.02	−0.0074	0.02	−0.0131	0.013
CHUS	0.2708***	0.02	0.2625***	0.01	0.3234***	0.01	0.4125***	0.02	0.3796***	0.012
NY	0.0067	0.02	−0.0205	0.02	−0.0598***	0.02	0.0412	0.03	−0.0119	0.018
LO	0.1467***	0.03	0.1147***	0.02	0.0984***	0.03	0.1386***	0.03	0.1531***	0.022
PA	−0.0320***	0.01	−0.0036	0.01	0.0241**	0.01	0.0311**	0.01	0.0189**	0.009
ay1981	−0.1081***	0.03	−0.0491*	0.03	0.0039	0.03	0.0047	0.04	−0.0205	0.023
ay1982	−0.1760***	0.03	−0.1553***	0.03	−0.1666***	0.03	−0.1772***	0.04	−0.1425***	0.024
ay1983	−0.1023***	0.03	−0.0460*	0.03	−0.0525*	0.03	−0.0148	0.04	−0.0272	0.024
ay1984	−0.0751**	0.03	0.0027	0.02	0.0624**	0.03	0.0735**	0.03	0.0408*	0.022
ay1985	0.1190***	0.03	0.1869***	0.02	0.2256***	0.03	0.2268***	0.03	0.2260***	0.022
ay1986	0.3727***	0.03	0.4713***	0.02	0.5334***	0.03	0.4973***	0.03	0.4993***	0.022
ay1987	0.8019***	0.03	0.8973***	0.02	0.9896***	0.03	0.9913***	0.03	0.9578***	0.021
ay1988	1.0988***	0.03	1.1907***	0.02	1.2583***	0.03	1.2777***	0.03	1.2398***	0.021
ay1989	1.4918***	0.03	1.6027***	0.02	1.7053***	0.03	1.6928***	0.03	1.6622***	0.021
ay1990	1.5839***	0.03	1.7113***	0.02	1.8702***	0.03	1.9168***	0.03	1.7943***	0.021
ay1991	1.2495***	0.03	1.2712***	0.03	1.3181***	0.03	1.2944***	0.04	1.2958***	0.024
ay1992	1.1472***	0.03	1.2140***	0.03	1.2064***	0.03	1.2129***	0.04	1.2144***	0.023
ay1993	0.9927***	0.03	1.0222***	0.02	1.0536***	0.03	1.0436***	0.03	1.0539***	0.023
ay1994	0.9632***	0.03	1.0050***	0.02	1.0362***	0.03	1.0443***	0.03	1.0275***	0.022
ay1995	1.0394***	0.03	1.0859***	0.03	1.0998***	0.03	1.0789***	0.04	1.1150***	0.023
ay1996	1.0064***	0.03	1.0550***	0.02	1.0804***	0.03	1.0974***	0.03	1.0981***	0.022
ay1997	1.0273***	0.03	1.0738***	0.02	1.0923***	0.03	1.0894***	0.03	1.1231***	0.023
ay1998	1.0813***	0.03	1.1616***	0.03	1.2022***	0.03	1.1890***	0.04	1.2274***	0.023
ay1999	1.1644***	0.03	1.2178***	0.03	1.2400***	0.03	1.2164***	0.04	1.2783***	0.024
ay2000	1.1396***	0.03	1.2227***	0.03	1.2741***	0.03	1.2599***	0.04	1.3127***	0.024
ay2001	1.0921***	0.03	1.1741***	0.03	1.2559***	0.03	1.2584***	0.04	1.2812***	0.024
ay2002	1.1820***	0.04	1.2789***	0.03	1.3491***	0.03	1.3448***	0.04	1.3727***	0.025
ay2003	1.3049***	0.04	1.4077***	0.03	1.4929***	0.03	1.4587***	0.04	1.4855***	0.025
ay2004	1.4764***	0.04	1.5895***	0.03	1.7017***	0.03	1.7007***	0.04	1.7005***	0.025
ay2005	1.6346***	0.04	1.7423***	0.03	1.8719***	0.03	1.8296***	0.04	1.8586***	0.028

Table 3 continued on next page

LNPRICE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
cdec1870	−1.2871***	0.18	−1.0974***	0.14	−0.0529	0.16	0.2351	0.20	−0.3382***	0.132
cdec1880	0.0871	0.09	0.1206*	0.07	0.9880***	0.07	1.3907***	0.09	0.6599***	0.061
cdec1890	0.0912	0.08	0.1458**	0.06	0.8808***	0.07	0.9794***	0.08	0.5921***	0.054
cdec1900	0.1873**	0.08	0.2057***	0.06	0.9037***	0.06	1.1520***	0.08	0.6569***	0.051
cdec1910	0.2037***	0.07	0.2327***	0.06	0.8374***	0.06	1.0004***	0.07	0.6067***	0.050
cdec1920	0.1587**	0.07	0.1721***	0.06	0.6766***	0.06	0.7561***	0.07	0.4841***	0.050
cdec1930	0.1815**	0.07	0.1479***	0.06	0.5721***	0.06	0.6301***	0.07	0.4190***	0.050
cdec1940	0.1733**	0.07	0.1252**	0.06	0.5186***	0.06	0.5349***	0.07	0.3835***	0.050
cdec1950	0.0814	0.07	0.0123	0.06	0.3388***	0.06	0.3085***	0.07	0.2261***	0.049
cdec1960	−0.0189	0.07	−0.1206**	0.06	0.1430*	0.06	0.0821	0.07	0.0638	0.049
cdec1970	−0.1400**	0.07	−0.2846***	0.06	−0.0872	0.06	−0.1651**	0.07	−0.1549***	0.049
cdec1980	−0.1540**	0.07	−0.3117***	0.06	−0.1769***	0.06	−0.2931***	0.07	−0.2316***	0.049
cdec1990	−0.1645**	0.07	−0.3418***	0.06	−0.1472**	0.06	−0.2363***	0.07	−0.2204***	0.050
TSD	−0.0149**	0.00	−0.0148***	0.00	−0.0129***	0.00	−0.0093***	0.00	−0.0138***	0.001
D-Dage	−0.0438***	0.01	−0.0478***	0.01	−0.0618***	0.01	−0.0625***	0.01	−0.0526***	0.005
D-Dage2	1.0857***	0.18	1.1687***	0.15	1.4773***	0.17	1.5087***	0.20	1.2807***	0.136
D-Dage3	−0.0066***	0.00	−0.0070***	0.00	−0.0086***	0.00	−0.0088***	0.00	−0.0076***	0.001
Constant	6.4448***	0.13	6.4264***	0.10	6.4909***	0.11	6.6770***	0.13	5.5609***	0.054
Observations	146,575		146,575		146,575		146,575		146,575	
Pseudo R^2	0.4396		0.4677		0.5246		0.5429		0.7298	
Coefficients are significant on the 10% (*), 5% (**) and 1% (***) level.										

Table 3 shows the estimation results of the 10%, 25%, 75%, and 90% quantile regressions, as well as the OLS estimates for comparison. The results with respect to the death effect confirm our OLS estimates. For all four quantiles we obtain an inverted U-shaped relationship between the death effect and the age at death, the critical age at which the effects becomes positive occurring at an age of 71 or 72. Figure 7 depicts the respective plots.

Figure 7: Death effect profiles for different quantiles



The plots shown in Figure 7 indicate that the death effect is more pronounced in the upper tail of the distribution (75% and 90% quantile) as compared to the OLS estimates, and smaller for lower quantiles (10% and 25%).[10] At an age at death of, for example, 65 years, the *death-induced price decrease* amounts to 14% (12%) in the 75% (90%) quantile, but only 7% (8%) in the 10% (25%) quantile. This corresponds well to our fourth hypothesis. Collectors buy works of potential future leading artist and thereby create upward pressure on the prices. If, however, the artist dies an untimely death, the hopes of the collectors are dashed and the prices drop. This effect is larger for great talents because the relationship between reputation and commercial success is highly non-linear.[11] For higher ages at death, the line-up of the *death-induced price increases* corresponds even better to the theoretical predictions: at an age at death of, for example, 85 years, the estimated death effects amount to 7%, 11%, 16% and 18% for the 10%, 25%, 75%, and 90% quantile. In interpreting these results, it is important to remember that we are dealing here with a sample of top achievers since we excluded all artists with less than 250 observations. We conjecture that the death effect would be significantly smaller for the excluded (less well-known) artists than the death effects identified here for the artists making up the bottom 10% of our sample of renowned artists.

With respect to the remaining explanatory variables, the quantile regressions yield some qualifications of the OLS estimates. First, the mark-up for oil paintings is especially pronounced for highly priced works of art. The coefficient is roughly twice as large for the 90% quantile than for the 10% quantile. The same holds for works on paper. Second, a signature is more important for less valuable artwork, price differences amounting to 25% for the 10% quantile and only 11% for the 90% quantile. We conjecture that for expensive artwork authentication is possible even if a piece is not signed, while for cheaper artwork the signature is the only (financially viable) authentication device. This argument would also explain why Czujack (1997) did not find a significant signature-effect for Picasso's works of art which are, as a rule, very expensive. Third, the size-effect on prices for oil paintings and drawings on paper does not appear to depend on quality, for prints, however, it does. Our estimates indicate that the size-induced price differences of prints vary positively with artistic achievement. A 10cm increase in the height of a print yields a 38% price increase for prints created by artists in the 10% quantile, while the corresponding increase amounts to 96% for prints by artists in the 90% quantile. The same holds for the width of a print. Fourth, the skyrocketing prices for late 19th century and early 20th century art are driven by high-end sales. The ratio between the estimated coefficients for these periods and those for the second half of the 20th century are much higher for the 75% and 90% quantiles than for the 10% and 25% quantiles. Finally, prices of artwork created by deceased minor artists depreciate much faster than the prices of artwork created by major artists, indicating that changes in preferences and taste cannot do much harm to artwork that is considered to be a top-achievement of a period even if the respective style does not anymore agree with current tastes.

[10] We do not report the estimates for the median quantile, because they do not differ significantly from the OLS estimates.

[11] The classic study on superstars is Rosen (1981).

6. Conclusions

In this study we extended the theory explaining death-induced changes in art prices by acknowledging that demand for works of art is to a large extent driven by the respective artist's reputation. We furthermore conduct a theory guided empirical test which takes into account that the direction and the size of the death effect depend on the artist's age at death. Our main theoretical contribution consists in demonstrating that the death effect is negative in the case of an untimely death. This result complements previous theoretical considerations that have focused on death-induced price increases. The negative death effect materializes because it takes a long time to build up a sustainable reputation in the global arts market. Thus, if a promising artist dies before her reputation reaches the level commensurate with the artistic quality of her work, the early collectors' hopes of owning a piece of art that is generally recognized to represent the value that would actually be justified by the artistic quality, is frustrated. The prices thus decrease after the artist's death.

Our empirical investigation shows that the death effect is indeed negative for artists who are unlucky enough to die young. It also shows that the reputation effect diminishes with increasing age at death, with the consequence that the traditional positive scarcity effect governs the price changes observed after the death of artists who die at a ripe age after having gained the reputation which they deserve. Our empirical results, moreover, bear out the prediction that the work of top artists is subject to more pronounced death effects than the work of merely accomplished artists, and the work of journeymen artists is even less affected.

We derive our empirical results from a data set comprising more than 400,000 observations. Since our analysis of the death effect is embedded in a set of standard hedonic art price regressions, we are able to reconfirm many results previously derived from much smaller datasets. In particular, we use our large dataset to run quantile regressions which reveal that the influence of some price determinants varies substantially across price or quality ranges. All our results are robust with respect to various econometric specifications and estimation techniques.

Our investigation has documented that reputation is a crucial determinant of art prices. Even though this is hardly a novel insight, it is worth emphasizing that the mechanisms underlying the death effect cannot be properly understood without taking the accumulation of reputation into account. The empirical literature has a tendency to downplay the influence of reputation because it is hard to measure. Future empirical research into art price formation, in general, and the death effect, in particular, would enormously benefit from a reputation measure which is independent of art prices or the length of the artists' careers.[12]

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[12] The "citation method", i.e. counting the number of reproductions or the length of entries in art history textbooks, represents a promising starting point. It can, however, only be applied to a relatively small number of artists with a claim to superstar status.

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Appendix 1: Data Description

Oil: 1 if artwork is an oil painting

Paper: 1 if artwork is on paper

Print: 1 if artwork is a print

Dage: Age at death, i.e. death year – birth year if artist is dead, 0 if artist is alive

Death: 1 if auction year equals death year, death year + 1 or death year + 2

D-Dage (Death times Dage),

D-DageS (D-Dage squared), D-DageT (D-Dage to the power of three), D-DageQ (D-Dage to the power of four) and D-DageP (D-Dage to the power of five), all divided by 1000

TSD: Time since death, i.e. auction year – death year, if auction year > death year +2

Signature: 1 if the work of art is signed by the artist

Ln Price: Logarithm of the real price in US-$, using the US-All-Urban CPI (1982=100)

Supply: Number of works of art (by the respective artist) auctioned in the respective year

Width: Width of the work of art in metres

Height: Height of the work of art in metres

OilWidth (Oil times Width), OilHeight (Oil times Height), OilsWidthS (OilWidth squared),Oil-HeightS (OilHeight squared), PaperWidth, PaperHeight, PaperWidthS, PaperHeightS, PrintWidth, PrintHeight ared defined corrspondingly

CHLO (SOLO): 1 if sold at Christie's (Sotheby's) London

CHNY (SONY): 1 if sold at Christie's (Sotheby's) New York

CHPA (SOPA): 1 if sold at Christie's (Sotheby's) Paris

CHUS (SOUS): 1 if sold at Christie's (Sotheby's) in the US, but not in New York

CHEU (SOEU): 1 if sold at Christie's (Sotheby's) in Europe, but not in Paris or London

NY: 1 if sold in New York, excluding Sotheby's and Christie's

LO: 1 if sold in London, excluding Sotheby's and Christie's

PA: 1 if sold in Paris, excluding Sotheby's and Christie's

US: 1 if sold in the US, but not at Sotheby's or Christie's and not in New York

EU: 1 if sold in the Europe, but not at Sotheby's or Christie's and not in London or Paris

JAP: 1 if sold in Japan

ay1980: 1 if auction year is 1980, etc.

cdec1870: 1 if creation year is between 1870 and 1880, etc.

cdec2000: 1 if creation year is between 2000 and 2005

Appendix 2: Summary Statistics

The following table reports the summary statistics of our data sets. The reduced sample excludes all artists with less than 250 auction records. The full dataset consists of 436,308 observations, the reduced sample of 146,575.

	Full Sample				Reduced Sample			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Oil	0.589	0.492	0	1	0.414	0.493	0	1
Paper	0.351	0.477	0	1	0.443	0.497	0	1
Print	0.060	0.237	0	1	0.143	0.350	0	1
Auctionyear	1996	6.647	1980	2005	1995	6.850	1980	2005
Birthyear	1903	25.086	1820	1980	1899	22.395	1858	1961
Deathyear	1968	20.553	1900	2005	1971	18.192	1920	2004
Dage	75.263	13.134	18	112	77.785	12.089	28	98
Death	0.032	0.177	0	1	0.035	0.183	0	1
TSD	21.019	21.298	0	105	20.999	18.874	0	85
Signature	0.881	0.323	0	1	0.877	0.328	0	1
LnPrice	8.420	1.559	5.263	18.348	9.217	1.619	5.613	18.348
Supply	28.042	81.990	1	831	71.275	130.638	1	831
Width	0.628	0.424	0.01	12.7	0.570	0.405	0.01	11.13
Height	0.607	0.396	0.01	10.16	0.554	0.369	0.02	9.01
OilWidth	0.430	0.495	0	11.13	0.295	0.459	0	11.13
OilHeight	0.410	0.467	0	9.22	0.282	0.427	0	7.75
OilWidthS	0.430	1.184	0	123.877	0.298	1.151	0	123.877
OilHeightS	0.387	0.842	0	85.008	0.262	0.688	0	60.062
PaperWidth	0.165	0.298	0	12.7	0.196	0.296	0	6.1
PaperHeight	0.162	0.288	0	10.16	0.191	0.282	0	9.01
PaperWidthS	0.116	0.593	0	161.29	0.126	0.497	0	37.21
PaperHeightS	0.109	0.481	0	103.2256	0.116	0.435	0	81.18011
PrintWidth	0.033	0.167	0	9.75	0.078	0.244	0	9.75
PrintHeight	0.034	0.166	0	6.43	0.081	0.243	0	6.43
SOLO	0.059	0.236	0	1	0.094	0.293	0	1
SONY	0.072	0.258	0	1	0.107	0.309	0	1
SOPA	0.001	0.023	0	1	0.001	0.026	0	1
SOUS	0.006	0.080	0	1	0.005	0.070	0	1
SOEU	0.031	0.173	0	1	0.025	0.158	0	1
CHLO	0.048	0.213	0	1	0.076	0.265	0	1
CHNY	0.042	0.200	0	1	0.062	0.241	0	1
CHPA	0.001	0.030	0	1	0.001	0.033	0	1
CHUS	0.053	0.223	0	1	0.039	0.194	0	1
CHEU	0.031	0.173	0	1	0.049	0.216	0	1
NY	0.018	0.132	0	1	0.018	0.132	0	1
LO	0.016	0.124	0	1	0.011	0.106	0	1
PA	0.118	0.323	0	1	0.140	0.347	0	1
US	0.040	0.196	0	1	0.015	0.120	0	1
EU	0.466	0.499	0	1	0.357	0.479	0	1
JAP	0.000	0.011	0	1	0.000	0.019	0	1
continued next page								

Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
ay1980	0.014	0.118	0	1	0.018	0.133	0	1
ay1981	0.014	0.119	0	1	0.018	0.132	0	1
ay1982	0.012	0.109	0	1	0.015	0.121	0	1
ay1983	0.014	0.118	0	1	0.017	0.129	0	1
ay1984	0.018	0.133	0	1	0.022	0.146	0	1
ay1985	0.020	0.141	0	1	0.024	0.153	0	1
ay1986	0.021	0.143	0	1	0.024	0.152	0	1
ay1987	0.027	0.163	0	1	0.031	0.174	0	1
ay1988	0.030	0.171	0	1	0.033	0.178	0	1
ay1989	0.040	0.196	0	1	0.044	0.205	0	1
ay1990	0.039	0.194	0	1	0.040	0.197	0	1
ay1991	0.025	0.157	0	1	0.023	0.148	0	1
ay1992	0.028	0.164	0	1	0.025	0.155	0	1
ay1993	0.035	0.185	0	1	0.033	0.178	0	1
ay1994	0.041	0.199	0	1	0.038	0.192	0	1
ay1995	0.042	0.200	0	1	0.038	0.191	0	1
ay1996	0.048	0.214	0	1	0.049	0.216	0	1
ay1997	0.054	0.227	0	1	0.059	0.235	0	1
ay1998	0.057	0.232	0	1	0.060	0.238	0	1
ay1999	0.056	0.229	0	1	0.055	0.228	0	1
ay2000	0.062	0.241	0	1	0.060	0.237	0	1
ay2001	0.063	0.243	0	1	0.058	0.233	0	1
ay2002	0.062	0.241	0	1	0.058	0.234	0	1
ay2003	0.066	0.248	0	1	0.063	0.242	0	1
ay2004	0.081	0.274	0	1	0.070	0.256	0	1
ay2005	0.030	0.170	0	1	0.027	0.162	0	1
cdec1870	0.000	0.020	0	1	0.000	0.018	0	1
cdec1880	0.006	0.079	0	1	0.005	0.070	0	1
cdec1890	0.018	0.131	0	1	0.013	0.112	0	1
cdec1900	0.040	0.195	0	1	0.035	0.184	0	1
cdec1910	0.082	0.274	0	1	0.072	0.258	0	1
cdec1920	0.111	0.314	0	1	0.106	0.308	0	1
cdec1930	0.099	0.299	0	1	0.099	0.299	0	1
cdec1940	0.106	0.308	0	1	0.116	0.320	0	1
cdec1950	0.136	0.343	0	1	0.161	0.367	0	1
cdec1960	0.153	0.360	0	1	0.175	0.380	0	1
cdec1970	0.106	0.308	0	1	0.112	0.315	0	1
cdec1980	0.096	0.295	0	1	0.085	0.279	0	1
cdec1990	0.039	0.194	0	1	0.020	0.194	0	1
cdec2000	0.007	0.085	0	1	0.002	0.086	0	1

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