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POSITIVE AND NEGATIVE EFFECTS OF SOCIAL STATUS ON LONGEVITY: EVIDENCE FROM TWO LITERARY PRIZES IN JAPAN

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ABSTRACT

It is widely believed that a rise in social status extends longevity. A handful number of studies examine datasets of candidates for prestigious prizes to exploit the causality. However, while some studies report positive relationships between receiving awards and recipients' longevity, others report negative relationships. In this study, we show evidence that receiving a prize has both positive and negative causal effects on recipients' longevity, by using a dataset covering Japan's most prestigious and traditional literary recognitions, the Akutagawa and Naoki Prizes.

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The results reveal that the recipients of the Akutagawa Prize for new or emerging novelists exhibit *lower* mortality than their fellow nominees. The *increase* in longevity is estimated at 1.4 years. By contrast, the recipients of the Naoki Prize mainly for established novelists report *higher* mortality than their fellow nominees, and the *decreased* longevity is estimated at 5.2 years. We discuss with additional empirical analyses that we are likely to find a life-prolonging effect from receiving a prize when candidates belong to a lower social stratum. In so doing, our findings provide narrative explanations for why earlier studies show conflicting relationships between receiving awards and recipients' longevity.

JEL: I12, H14

Keywords: Social Status, Mortality, Health Inequality, Cox's Proportional Hazard Model, Time-dependent Covariates, Time-dependent Parameters

1. INTRODUCTION

1.1. Background and literature review

There is considerable academic interest in whether a rise in social status extends longevity. Although several studies report positive correlations between social status and longevity/health (Marmot et al., 1978; Marmot et al., 1984; Marmot et al., 1991; Reid et al., 1974; Rose and Marmot, 1981), their results do not demonstrate the causality from social status to longevity, given that a reverse causality is also possible (Boyce and Oswald, 2012).

To exploit the causality, a handful number of studies examine datasets of candidates for prestigious prizes, including the Academy Awards (Oscars®), the Nobel Prize, etc. They do so, because the recipients and nominees of distinguished awards are likely to be homogeneous in multiple aspects and being awarded a prize can be viewed as an exogenous shock to their social status. This allows them to exploit a causal effect from heightened social status to longevity, by comparing the life expectancies and mortality rates of recipients and fellow nominees. Adopting this empirical strategy, Redelmeier and Singh (2001a) show that actors and actresses who receive Oscars® live 3.6 years *longer* than Oscar® nominees and support their hypothesis that a rise in social status has a positive causal effect on longevity.

Table 1. Studies examining relationships between receiving awards and recipients' longevity

Papers	*Prestigious prizes*	*Positive effect, or negative effect*	*Summary*
Redelmeier and Singh (2001a)	Academy Award for actors and actresses	Positive effect	Actors and actresses who receive Oscars® live 3.6 years longer than fellow nominees.
Rablen and Oswald (2008)	Nobel Prize in chemistry and physics	Positive effect	Nobel laureates in chemistry and physics live 1.6 years longer than fellow nominees.
Liu et al. (2017)	China's academician election	Positive effect	Candidates elected to the Chinese Academy live 1.2 years longer than fellow candidates.
Redelmeier and Singh (2001b)	Academy Award for screenwriters	Negative effect	Screenwriters who receive Oscars® live 3.6 years less than fellow nominees.
Abel and Kruger (2005)	Baseball Hall of Fame	Negative effect	Players inducted into the Baseball Hall of Fame live 5.0 years less than similar-age players.
Olenski et al. (2015)	National election to a head of government	Negative effect	Candidates who served as a head of government live 4.4 years less than those who did not.
Leive (2017)	Olympic Track and Field games	Negative effect	Gold medalists in Olympic Track and Field games live 2.0 years less than Silver medalists.

Notes: Positive effect means that receiving a prize extends recipients' longevity. By contrast, negative effect means that receiving a prize shortens their longevity.

However, as shown in Table 1, some studies report positive relationships between receiving awards and recipients' longevity, while others report negative relationships. There are two explanations for such conflicting results. First, receiving a prize has both positive and negative causal effects. Second, analytical accuracy and precision differ by study and these differences cause the size and directionality of the effects to vary.

The following literature explores the second possibility, to our knowledge. Sylvestre et al. (2006) and Han et al. (2011) highlight that Redelmeier and Singh (2001a) do not properly deal

with an *immortal time bias*, that is, the possibility that actors and actresses who live longer have more opportunities to earn Oscars. To eliminate the bias, Sylvestre et al. (2006) re-estimate Redelmeier and Singh's (2001a) dataset by using a Cox proportional hazard model with time-dependent covariates, treating a recipient as a nominee until they receive a prize, allowing other covariates to also vary, and controlling the recipient's status and activities between their first nomination and winning. They show that the effect of receiving Oscars® on longevity is positive but statistically insignificant.

However, it remains possible that the first explanation is credible. Rablen and Oswald (2008), using a method similar to that of Sylvestre et al. (2006), demonstrate that the effect of receiving the Nobel Prizes on longevity is positive and statistically significant. Thus, after properly addressing the *immortal time bias*, one study reports a positive causal effect on longevity, while another suggests no effect. In other words, although differences in how studies address the bias partly explain differences in the size and directionality of the effects of receiving the prizes, it still remains unclear why studies have produced conflicting results on the effects.

1.2. Hypothesis

This study explores the possibility that receiving a prize has both positive and negative causal effects on longevity. We first investigate why previous studies have proposed the hypothesis

that receiving a prize has only a positive effect.

We find three mechanisms backing the hypothesis. The first is based on improving mental health: people with a higher social status are less likely to compare their own status with others' and to experience feelings of shame, embarrassment, depression, and social anxiety (Dickerson and Kemeny, 2004; Gorin, 2000; Sapolsky, 2005; Scheff, 1988; Wilkinson and Pickett, 2010). The second is related to reducing work-related psychological stress: people with a higher social status generally have greater control over their jobs and can avoid forced and monotonous jobs (Bosma et al., 1997; Marmot et al., 1997; Sapolsky, 2005; Schnall et al., 1994; Wilkinson and Pickett, 2010). The third is enhancing a recipient's economic conditions: people with a higher social status have greater income and access to health-enhancing goods and services, such as better living conditions, nutritious meals, and quality medical care (Bloom and Canning, 2000; Deaton, 2003; Grossman 1972; Marmot, 2002; Preston, 1975; Subramanian and Kawachi, 2006).[1]

However, some recent studies present one possibility that although the first effect through social comparisons is constantly positive, the second effect related to work environments is sometimes negative (Damaske et al., 2016). That is, a rise in social status can increase work-related psychological stress rather than reduce it. Other studies present another possibility that

[1] Among studies with prestigious prizes, Redelmeier and Singh (2001a) discuss that award winners are likely to have personal chefs, trainers, or other staff and they enable the winners to follow ideal lifestyles.

the third effect through improving economic conditions is positive but heterogeneous with social stratification (Deaton, 2003).[2] The third positive effect can be larger (smaller) when people are in a lower (higher) social stratum. If these two possibilities are valid, we can hypothesize that receiving a prize has a life-prolonging effect when candidates belong to a lower social stratum. In this case, the positive economic effect is strengthened, and the sum of the two positive effects exceeds the negative work-related effect.

We introduce recent studies supporting that the second effect related to work environments is sometimes negative.[3] Epidemiology and sociology indicate that highly ranked job classifications involve long working hours and high work demands, and these factors generate psychological stress (Damaske et al., 2014; Damaske et al., 2016; Schieman et al., 2006). Damaske et al. (2016) show that workers with a higher social status report greater stress at work and are more likely to fail in meeting work demands than those with a lower social status. A rise in social status would compound workload, and workers with a higher social status might struggle to meet competing needs and deadlines, working without rest. Furthermore, it is known

[2] This study defines social stratification as classifying individuals into groups with different relative positions in communities, including occupational ones. Individuals who belong to the same social stratum share a similar social status, but there are certain variations in the social status even within the same social stratum. For example, new or emerging novelists similarly belong to the lower social stratum in the (unofficial) literary community, *Bundan*. At the same time, there are novelists with a relatively high social status, such as those who receive awards or great job opportunities as rookies.

[3] It is theoretically and empirically known that the first effect through social comparisons is positive and constant with social stratification. When people have higher social status and income within the same social stratum, it increases utility, well-being, happiness, and satisfaction, and even decreases mortality risk (Ball and Chernova, 2008; Boes et al., 2010; Clark et al., 2009; Ferrer-i-Carbonell and Frijters, 2004; Miller and Paxson, 2006; Subramanian and Kawachi, 2004, 2006; Wagstaff and Van Doorslaer, 2000). Some studies find a strong positive effect of relative income on utility and health status even in developed countries and among wealthy people (McBride, 2001; Deaton, 2003).

that working hours and work demands are positively correlated with job authority, autonomy, and non-routineness (Reskin and Ross, 1992; Schieman et al., 2006). Thus, we would find the strengthened negative effect in the sample occupations characterized by such work conditions. In fact, Redelmeier and Singh (2001b) and Olenski et al. (2015) use samples of screenwriters and politicians, showing that a rise in social status increases mortality risk.

Other studies support that the third positive effect through improving economic conditions is strengthened when people belong to a lower social stratum and it weakens as their social stratum elevates. Epidemiology, sociology, and economics agree that there is a non-linear and concave relationship between absolute income and health (Deaton, 2003; Subramanian and Kawachi, 2006). Several studies empirically show this association using cross-section and panel datasets of countries, communities, households, and individuals (Deaton, 2003; Gerdtham and Johannesson 2004; Lorgelly and Lindely 2008; Preston, 1975; Pritchett and Summers, 1996; Rogot et al., 1992).[4]

Accounting for the above discussion, we hypothesize that we find a positive net effect on longevity from receiving a prize when using a sample of individuals with atypical occupations and in a lower social stratum. In this case, the positive effect through improving economic

[4] We find a stronger positive economic effect among people in a lower social stratum, because people who have a lower social status within the lower social stratum, such as the poorer, are less likely to care about their health. Behavioral economics indicates that poverty impedes cognitive function and fosters present-biased decision-making (Carvalho et al., 2016; Mani et al., 2013). People who have present-bias tend to indulge in risky behaviors, including overeating, drinking, and smoking. Marmot et al. (1991) report that in the United Kingdom, a decrease in such risky behaviors explains one-third of the positive correlation between job classifications and the health status of civil servants.

conditions is strengthened and the sum of the two positive effects exceeds the negative effect related to work environments. Conversely, when the sample belongs to a higher social stratum, the negative effect prevails. In other words, heterogeneity in the positive economic effect partly explains whether receiving a prize has a positive or negative net effect on longevity.

We test the hypothesis by using datasets of Japan's two literary prizes, the Akutagawa and Naoki Prizes. Testing the hypothesis requires two types of datasets: one comprises candidates in atypical occupations and a lower social stratum, and the other comprises candidates in similar occupations but in a higher social stratum. As we will explain in Section2, the dataset of the Akutagawa Prize for new or emerging novelists fulfills the former's requirement, and that of the Naoki Prize mainly for established novelists fulfills the latter's one. That is, our empirical hypothesis is that receiving a prize has a life-prolonging effect in the Akutagawa Prize sample.

2. DATA

2.1. Overview of Akutagawa and Naoki Prizes

The Akutagawa and Naoki Prizes are Japan's most prestigious and traditional literary recognitions.[5] Print, broadcast, and Internet media cover their recipients, and receiving either

[5] Among novelists awarded or nominated for the Nobel, Kenzaburo Oe received the 39th Akutagawa Prize in 1958 and the Nobel Prize for literature in 1994. Similarly, Kobo Abe won the 25th Akutagawa Prize, Shusaku Endo won the 33rd, and Haruki Murakami was nominated for the 81st and 83rd Akutagawa Prizes. Yasunari Kawabata, Junichiro Tanizaki, and Yukio Mishima were members of the review committee for the Akutagawa Prize. Works by candidates for the Naoki Prize, including Ryotaro Shiba and Jiro Akagawa, have sold more than 100 million copies worldwide, paralleling the sales of worldwide best-selling novelists Steven King and Sidney Sheldon (BBC News and Current Affairs, 2006; Cable News Network, 1999; Japan Inc Communications, Inc., 2006; The Nishinippon Shimbun Co., Ltd., 2016).

delivers an equivalently tremendous shock to social status.

The prizes share several characteristics and are often viewed as two sides of the same coin. They were simultaneously established in 1935 and sponsored by the same organizations, Bungeishunju Ltd. and the Society for the Promotion of Japanese Literature. Novelists can receive either prize only once, but those who have received neither can be candidates for both. Both have similar selection procedures and identical monetary and material rewards,[6] and are awarded twice a year (January and July). The 154th awards are presented on January 19, 2016. There have been 1,061 candidates, of whom 344 have received one of the two prizes.

However, a key difference exists. The Akutagawa Prize is awarded to new or emerging novelists. This prize is also given for serious literature, which sells less than popular literature in Japan. They generally have low income and a high level of anxiety about their future. In these senses, the candidates are in the lower stratum in the unofficial literary community, *Bundan*. By contrast, candidates for the Naoki Prize include a larger number of established novelists and the prize is awarded for popular literature. Thus, the candidates are expected to be in the higher social stratum.

The Akutagawa and Naoki Prizes dataset parallels that of similar studies while better

[6] Recipients receive prize money (¥1,000,000 = US $8,262, as per the 2015 exchange rate) and a pocket watch. The monetary amount is identical for both prizes and the relative level does not vary over time. However, this does not mean that the positive economic effect of receiving a prize is identical for both prizes. We define the positive economic effect not as the effect of receiving the prize money but as that of improving a recipient's economic conditions, including greater job opportunities, higher payment fees, better living conditions, nutritious meals, and quality medical care.

enabling us to draw causal inferences to longevity. First, the Akutagawa and Naoki Prizes are awarded for works published between semiannual awards. Works appear near the date of award presentation and the social stratum at the time of publication is similar to that upon receiving the award. Second, candidates in our dataset know they are being considered. That is, the causal effect from wining prizes to longevity includes the discouragement of unsuccessful nominees. These two characteristics are shared by the Oscar® (Redelmeier and Singh, 2001a, 2001b).

Third, our candidates can receive either prize only once. However, this is not the case in Redelmeier and Singh (2001a, 2001b) or Rablen and Oswald (2008). If candidates can receive the same award multiple times, the analysis must consider that the previous recognition might alter covariates for the second award.[7] Analyzing datasets of the Akutagawa and Naoki Prizes allows us to ignore such influences.

[7] Rablen and Oswald (2008) exclude recipients of multiple Nobel Prizes from the sample. Han et al. (2011), Robins (1986, 1992), and Robins et al. (1992) use and develop *g-estimation* to eliminate bias caused by repeat recognition.

2.2. Data sources

Table 2. Information sources for dataset

	Information sources
List of recipients and fellow nominees	Bungeishunju Ltd.'s (2014a) official records
Date of birth Place of birth Date of death Educational background Job other than a novelist Other prizes besides the two prizes	Four biographical dictionaries for novelists in Japan (Nichigai Associates, Inc., 2002; Nichigai Associates, Inc., 2004; Japan Writers' Association, 2015; Shinchosha Publishing Co., Ltd., 1988) Japan's literary prizes homepages
Published books	Database of National Diet Library in Japan (2015)
Cause of death (suicide or not)	Three newspaper databases (The Asahi Shimbun Company, 2015; The Mainichi Newspapers, 2015; The Yomiuri Shimbun, 2015)

Note: We identify recipients and nominees from Bungeishunju Ltd.'s (2014a) official records and reaffirm information accuracy by using supplemental documents (Bungeishunju Ltd., 2014b; Kawaguchi, 2015a, 2015b). Japan's Publishers must legally provide all of their publications to the National Diet Library.

Our dataset covers the candidates for the 1st to 154th awards. The dataset captures their name, date and place of birth, date and cause of death (suicide or not)[8], education, job other than being a novelist, other literary prizes received[9], and books published. We construct this dataset from multiple sources, as shown in Table 2. For example, we identify recipients and nominees from Bungeishunju Ltd.'s (2014a) official records and reaffirm information accuracy by using

[8] Records for some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record, considering it in our empirical analysis.

[9] We consider the following literary prizes in Japan: *All Yomimono Shinjin*, *All Yomimono Suiri Shousetsu Shinjin*, *Asahi Shinjin Bungaku*, *Asahi Shimbun Kenshou*, *Bungaku*, *Bungakukai Shinjin*, *Bungei*, *Dazai Osamu*, *Gunzou Shinjin Bungaku*, *Kawabata Yasunari Sakka*, *Mishima Yukio*, *Noma Bungei*, *Noma Bungei Shinjin*, *Noma Bungei Shourei*, *Sakka* (*Doujin*), *Shibata Renzaburo*, *Shinchou Shinjin*, *Shinchosha Bungaku*, *Shinchosha Bungei Dai 1 Bu*, *Shinchosha Bungei Dai 2 Bu*, *Shousetsu Gendai Shinjin*, *Shousetsu Subaru Shinjin*, *Sunday Mainichi Taishu Bungei*, *Subaru Bungaku*, *Tanizaki Junichiro*, *Umitsubame Shinjin Bungaku*, *Yamamoto Shugoro*, *Yoshikawa Eiji Bungaku*, *Yoshikawa Eiji Bungaku Shinjin*, and *Waseda Bungaku Shinjin*.

supplemental documents (Bungeishunju Ltd., 2014b; Kawaguchi, 2015a, 2015b).[10]

2.3. Descriptive statistics

Our analysis uses 708 observations of novelists, of whom 363 (345) are recipients and nominees of the Akutagawa (Naoki) Prize.[11] In Table 3, Panel A presents the descriptive results of the outcome variable, age at death, and reveals that, on average, Akutagawa Prize recipients are 6.3 years *older* at death than their fellow nominees (1% statistical significance) and Naoki Prize recipients are 2.4 years *younger* than their fellow nominees (10% statistical significance).

Although we recognize that the descriptive results cannot support causal claims, the results are consistent with our empirical hypothesis. The hypothesis depends on the assumption that the Akutagawa Prize is for new or emerging novelists and its candidates are in the lower social stratum compared to those for the Naoki Prize. We attempt to support the assumption, by using information on candidates' age and number of published books.

We examine candidates' ages when they were first nominated. Panel B (Table 1) shows that their average ages at the first nomination are 36.4 and 42.5 years for the Akutagawa and

[10] We collect information from four biographical dictionaries for Japanese novelists (Japan Writers' Association, 2015; Nichigai Associates, Inc., 2002; Nichigai Associates, Inc., 2004; Shinchosha Publishing Co., Ltd., 1988). We determine whether nominees have received other literary prizes by referencing "Akutagawa shou monogatari" (The story of the Akutagawa Prize; Kawaguchi, 2013) and "Naoki shou monogatari" (The story of the Naoki Prize; Kawaguchi, 2014). We compile published books from the National Diet Library (2015) database and identify whether candidates commit suicide from obituary notices published in newspapers (Asahi Shimbun Company, 2015; Mainichi Newspapers, 2015; Yomiuri Shimbun, 2015).

[11] We exclude novelists nominated for both prizes, one novelist with a corporate identity, and two joint nominations. We also exclude novelists for whom dates of birth or death are unavailable. Our analysis covers Japanese male novelists to avoid gender-based and racial based differences in life expectancy.

Naoki Prize. On average, nominees for the Akutagawa Prize are 6.1 years younger than those for the Naoki Prize. In addition, the duration between debut and first nomination is shorter for the Akutagawa Prize than the Naoki Prize. These results support that the candidates for the former include a larger number of new or emerging novelists.

Next, we investigate the number of books published before a candidate's first nomination, for which we collected information from the National Diet Library database. Publishers must legally provide all of their publications to the library. In fact, the library owns almost all the books, which are particularly published for commercial purposes (The National Diet Library, 2008). This feature helps check whether our assumption is plausible. Publishers conclude a commercial publishing contract with novelists when they expect the works to generate market demand. If a candidate has published several books prior to their first nomination for either prize, this means they are commercially established novelists.

Panel B shows that the number of books published before the first nomination is smaller for the Akutagawa Prize than the Naoki Prize. Furthermore, almost half of the candidates for the former have not published even one book before their first nomination. These results support that the Akutagawa Prize is for new or emerging novelists and its candidates are in the lower social stratum than those for the Naoki Prize.

However, the descriptive results could include reverse causality, particularly an *immortal time bias* that novelists who live longer have more opportunities to be nominated and are more

Table 3. Descriptive statistics

Panel A. Age at death and death (dummy)

	Akutagawa Prize			Naoki Prize		
	Recipients N = 109	Fellow nominees N = 254		Recipients N = 125	Fellow nominees N = 220	
Variable name	Mean (SD)	Mean (SD)	Difference (SE)	Mean (SD)	Mean (SD)	Difference (SE)
Age at death	74.42 (12.90)	68.09 (15.72)	6.33*** (2.42)	72.48 (11.36)	74.89 (12.10)	-2.42* (1.74)
Death (Dummy)	0.50 (0.50)	0.51 (0.50)	-0.01 (0.06)	0.58 (0.50)	0.60 (0.49)	-0.02 (0.06)

Panel B. Social stratification

		Akutagawa Prize	Naoki Prize	
		Recipients and fellow nominees N = 363	Recipients and fellow nominees N = 345	
Variable name	Time	Mean (SD)	Mean (SD)	Difference (SE)
Age	At 1st nomination	36.39 (8.05)	42.48 (8.41)	-6.09*** (0.62)
Duration (years) b/w debut and 1st nomination		3.06 (5.67)	5.94 (7.11)	-2.88*** (0.48)
Number of published books	At 1st nomination	3.67 (11.84)	8.89 (15.02)	-5.22*** (1.01)
Proportion of no published book	At 1st nomination	0.45 (0.50)	0.21 (0.41)	0.25*** (0.03)

Panel C. Comparison of recipients and fellow nominees

		Akutagawa Prize			Naoki Prize		
		Recipients N = 109	Fellow nominees N = 254		Recipients N = 125	Fellow nominees N = 220	
Variable name	Time	Mean (SD)	Mean (SD)	Difference (SE)	Mean (SD)	Mean (SD)	Difference (SE)
Age	At 1st nomination	35.33 (7.14)	36.85 (8.39)	-1.53** (0.92)	41.95 (7.86)	42.79 (8.71)	-0.84 (0.94)
Duration (years) b/w debut and 1st nomination		2.70 (4.59)	3.21 (6.08)	-0.51 (0.65)	6.77 (7.85)	5.46 (6.63)	1.31** (0.79)
Number of published books	At 1st nomination	3.73 (7.87)	3.65 (13.19)	0.08 (1.36)	11.71 (19.17)	7.29 (11.79)	4.42*** (1.67)
Proportion of no published book	At 1st nomination	0.35 (0.48)	0.50 (0.50)	-0.15*** (0.06)	0.14 (0.35)	0.25 (0.43)	-0.10** (0.05)
Number of nominations	B/W 1st and final nominations	2.00 (1.31)	1.70 (1.14)	0.30** (0.14)	2.49 (1.76)	1.70 (1.16)	0.78*** (0.16)
Number of published books	B/W 1st and final nominations	1.66 (3.42)	0.94 (2.89)	0.72** (0.35)	10.84 (21.02)	4.39 (12.93)	6.45*** (1.83)
Number of other prizes	B/W 1st and final nominations	0.11 (0.37)	0.04 (0.19)	0.07*** (0.03)	0.07 (0.26)	0.05 (0.33)	0.02 (0.03)

Note for Panels A, B, and C: (1) SD is a standard deviation, and SE is a standard error. (2) *** p<0.01 (one sided test), ** p<0.05 (one sided test), * p<0.1 (one sided test). (3) The mean of age at death is calculated by using only the sample who have been dead. That sample's number is 183 in the Akutagawa Prize and 203 in the Naoki Prize. (4) The variable "proportion of no published book" means the proportion of the candidates who had no publication at their first nomination.

likely to be awarded. Panel C indicates differences in some aspects at the first nomination between recipients and fellow nominees in both prizes, as similarly observed in the literature. In addition, recipients' numbers of total nominations, published books, and other prizes between the first and final nominations are greater than those for the fellow nominees. The latter results indicate the *immortal time bias*. In the next section, we introduce how our analysis statistically deals with this issue.

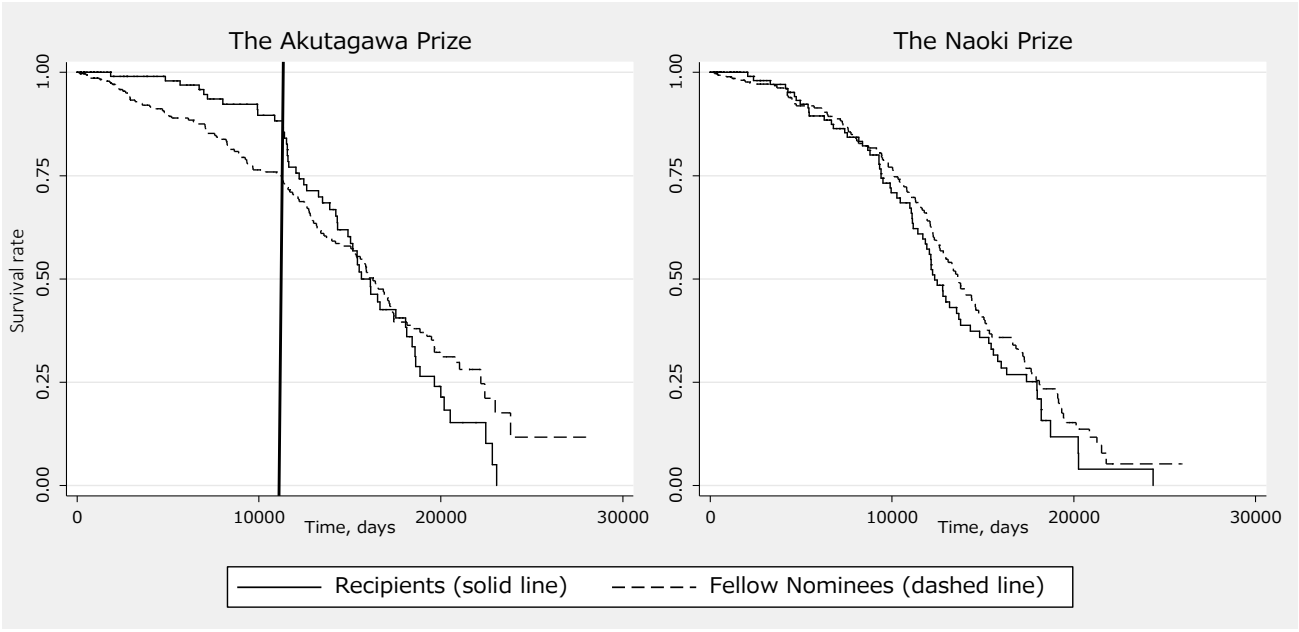
3. MODEL

3.1. Time-varying covariates and time-varying parameters

Our analyses use Cox's proportional hazard model with time-varying covariates and time-varying parameters. The key advantage of this model is that it allows us to empirically deal with an *immortal time bias* (Rablen and Oswald, 2008; Shintani et al., 2009; Simon and Makuch, 1984; Sylvestre et al., 2006). Recipients are required to publish a work enough to be awarded after first nomination. They are likely to be more enthusiastic about creating works between their first and final nominations (or winning) than unsuccessful nominees, and the activities could relate the recipients' health levels. If we do not consider the difference, the estimated parameter of winning a prize could include an *immortal time bias*. We apply time-varying covariates, addressing the bias. More precisely, we set time-zero as the date of first nomination, and construct the dataset in a panel format capturing the first and final nominations. Then, using

time-dependent covariates, we code recipients as nominees until they receive a prize, and allow age, number of nominations, published books, and other prizes received to vary between their first nomination and winning. In so doing, we consider the recipients' status and activities after their first nomination.

Figure 1. Survival functions for recipients and fellow nominees (Graph)



Notes: 10,000 days = 27.4 years, 20,000 days = 54.8 years, and 30,000 days = 82.2 years. The vertical line within the Akutagawa Prize's graph shows 11,000 days, almost 30 years.

Furthermore, it is possible that the parameter of receiving a prize also varies with time (Kleinbaum and Klein, 2012), although the basic Cox's proportional hazard model assumes they do not. Not considering this could generate biased parameters (Box-Steffensmeier and Zorn, 2001). Since we examine the long-term effect of receiving a prize, it could make the effect

hold time-dependency. Therefore, we should explore and address the possibility, as in the case of many medical studies and some social science studies (Barros et al., 2011; Zhelyazkova and Torenvlied, 2009). To evaluate the time-dependency of parameters of winning, we draw on Kaplan–Meier's survival functions (Figure 1). The values on the vertical axis are survival rates and those on the horizontal axis are the number of days between the first nomination and death. We treat as censored samples novelists who are still alive at stopping observing, January 19, 2016, and those who died from non-natural cause, suicide.

If the parameters of receiving prizes hold time-dependency, the reduction rates for the survival functions among recipients vary with time. Figure 1 reveals that the reduction rate among the Akutagawa recipients sharply increases by 11,000 days (almost 30 years) after the first nomination. We find no such change in the reduction rate for the Naoki recipients.[12,13] In sum, the parameter for receiving the Akutagawa Prize varies with time. It could change after 30 years following an author's first nomination; however, a similar time-dependency is not observed for recipients of the Naoki Prize.

Finally, the model allows us to use a sample with candidates who are still alive and conduct a survival analysis. In addition, it allows us to control differences in certain attributes at the first

[12] In Appendix A, we evaluate Akutagawa recipients' survival function, by using cumulative survival table. The results still suggest that the reduction rate among the Akutagawa recipients sharply rises by 11,000 days after their first nomination.

We also confirm this finding, by conducting a test detecting specification errors in a Cox's proportional hazard model.

[13] We interpret that the time-dependency in the Akutagawa Prize is generated by a ceiling effect. Even if receiving the Akutagawa Prize extends recipients' longevity, this longevity might not exceed the biological upper limit of the lifespan.

nomination between the recipients and fellow nominees by adding the attribute covariates. Also, we calculate the propensity score for winning a prize and check whether our main results are stably observed when using the subsample within the common support.

3.2. Estimation model and variables

We estimate the following equation:

$$\begin{aligned}\lambda(\mathrm{t}|\mathrm{x}) = \lambda_0(\mathrm{t}) \times \exp(&\beta_{1-1}\mathrm{Winner} + \beta_{1-2}\mathrm{Winner} \times (t > 11{,}000) + \beta_2\mathrm{Age} \\ &+ \beta_3\mathrm{Number\ of\ Nominations} + \beta_4\mathrm{Number\ of\ Published\ Books} \\ &+ \beta_5\mathrm{Number\ of\ Other\ Prizes} + z'\gamma). \qquad (1)\end{aligned}$$

The equation is divided into the baseline hazard of $\lambda_0(\mathrm{t})$ and the regression of $\exp(\ldots)$. In the regression, the variable Winner, distinguishes recipients from fellow nominees. We add $\mathrm{Winner} \times (t > 11{,}000)$ to the regression analyzing the Akutagawa Prize and consider the time-dependency of the parameter for receiving the prize. We also add time-varying covariates for age, number of nominations, books published, and other prizes received. Furthermore, we add several time-invarying covariates related to birth year, winning rate[14] when nominated, educational background, job other than a novelist, and place of birth. For example, to consider

[14] We define winning rate as the proportion of winners among nominees for each prize.

the differences in economic safety nets, we use information on other jobs.

4. RESULTS

4.1. Basic analysis results

Table 4 presents the estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100.

Column A1 shows that the recipients of the Akutagawa Prize exhibit 62.6% *lower* mortality than other nominees for 30 years after the first nomination. After 30 years, their mortality rises additionally four times *higher* than the control group. According to Column N1, Naoki Prize recipients exhibit 60.0% *higher* mortality than fellow nominees. The three effects are statistically significant at 1%. The accompanying columns show these effects are stably observed when adding a suicide dummy and using the subsample within the common support.[15]

These results suggest that receiving the Naoki Prize has a negative causal effect; however, we still cannot state that receiving the Akutagawa Prize affirmatively and causally affects longevity for the entire study period. To evaluate the average directionality and size of the effect of receiving the Akutagawa Prize, we use the predicted value to calculate the longevity of each

[15] In Appendix B, we re-measure survival from date of birth, presenting additional estimation results. We find that even if the starting point is different, the implications are the same.

Table 4. Basic analysis: effects of receiving a prize on mortality

Probability-of-death equations with time-varying covariates		Akutagawa Prize			Naoki Prize		
Time-zero: date of first nomination		**A1**	**A2**	**A3**	**N1**	**N2**	**N3**
Akutagawa Prize winner:		0.374***	0.357***	0.346***			
		(0.123)	(0.116)	(0.121)			
	After 30 years	4.071***	4.363***	4.674***			
		(1.571)	(1.668)	(1.909)			
Naoki Prize winner:					1.600***	1.637***	1.584***
					(0.260)	(0.269)	(0.269)
Time-varying covariates:	Age	1.047***	1.049***	1.066***	1.078***	1.080***	1.088***
		(0.017)	(0.016)	(0.020)	(0.016)	(0.016)	(0.016)
	Number of nominations (Akutagawa)	1.210***	1.206***	1.197**			
		(0.086)	(0.084)	(0.088)			
	Number of nominations (Naoki)				0.840***	0.840***	0.823***
					(0.053)	(0.053)	(0.054)
	Number of published books	0.989	0.989	0.996	1.003	1.003	1.002
		(0.010)	(0.009)	(0.013)	(0.003)	(0.003)	(0.005)
	Number of other prizes	0.970	0.972	0.953	0.998	0.985	1.033
		(0.119)	(0.120)	(0.128)	(0.081)	(0.081)	(0.074)
	Suicide dummy		11.600***	16.404***		14.832***	14.138***
			(4.597)	(6.669)		(6.180)	(5.663)
Time-invarying covariates:		Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:		363	363	328	345	345	329
Number of observations:		1,409	1,409	1,361	1,901	1,901	1,862

Notes: (1) Robust standard errors (exponentiated form) in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) We express estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100. (4) Time-invarying variables are birth year, winning rate when nominated, educational background, job other than a novelist, and a place of birth. (5) Records of some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record as a covariate. Also, to consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate. (6) When checking the time-dependency of the parameter among the Akutagawa recipients, we find that the reduction rate of the survival function sharply rises by 30 years after the first nomination. We find no change in reduction rate among Naoki recipients. (7) In columns A3 and N3, we use the subsample within the common support. We use information at first nomination to calculate the propensity score for winning a prize, and use the propensity score to construct the common support.

novelist and compare it between recipients and fellow nominees. The expected longevity for the recipients of the Akutagawa Prize is 1.4 years *longer* than that for the nominees. By contrast, the expected longevity for the recipients of the Naoki Prize is 5.2 years *shorter* than that for the nominees.[16] Hence, we can say definitively that receiving the Akutagawa Prize has a positive causal effect on longevity throughout the study period, whereas receiving the Naoki Prize has a negative causal effect.

Next, we present the estimation results for age and number of nominations among several covariates. Table 4 shows that aging increases mortality in both prize datasets and a larger number of nominations increases the mortality of candidates for the Akutagawa Prize but reduces it for those for the Naoki Prize. The former result is intuitive. We explain the latter by surmising that the two prizes cause different degrees of mental shocks from not receiving the award. Unsuccessful nominees for the Akutagawa Prize cannot hope to receive it after becoming established authors, while those for the Naoki Prize can, assuming their standing as established authors does not falter. Perhaps, the mental shock from not receiving the award is larger among candidates for the Akutagawa Prize. In addition, the publicity effect would be larger among candidates for the Naoki Prize. Since the candidates have published more books, their nomination for a prestigious award could boost sales of previous publications.

[16] The *increased* longevity is estimated at 1.4 years (in column A1), 1.3 years (A2), and 1.1 years (A3), while the *decreased* longevity is estimated at 5.2 years (N1), 5.5 years (N2), and 4.9 years (N3).

Here, some might argue that we fail to control unobserved factors, including unsuccessful nominees' expectations, and it causes the differential effects of receiving the prizes. However, we arrest this concern in Appendix C. If the two prizes' candidates constitute different populations defined by such unobserved factors, estimation results of receiving the prizes with the combined dataset will be inconsistent with those with each dataset. In Appendix C, we actually combine the datasets of the Akutagawa and Naoki Prizes, assume that every candidate is extracted from a common population, and investigate the effect of receiving the Akutagawa or Naoki Prize. We find that the estimation results of the combined dataset are still consistent with those for each dataset.

4.2. Additional analysis results for interpretations

The above analysis shows that receiving the Akutagawa Prize has a positive causal effect on longevity, whereas receiving the Naoki Prize has a negative causal effect. These results are consistent with our empirical hypothesis that receiving a prize has a life-prolonging effect in the Akutagawa Prize sample. We constructed the hypothesis using the following reasoning. First, previous studies suggest that among the effects of winning prizes on longevity, the negative effect related to work environments occurs in atypical occupations and the positive effect through improving economic conditions is strengthened when candidates belong to a lower social stratum. Second, narrative descriptions and statistics support that the Akutagawa Prize is

for new or emerging novelists and its candidates are in the lower social stratum than those for the Naoki Prize. Accordingly, we infer that when using the Akutagawa Prize sample, the positive economic effect is strengthened and the sum of the positive effects exceeds the negative work-related effect.

To the best of our knowledge, no previous study simultaneously shows the existence of positive and negative net effects, by using two types of datasets that are identical in most aspects but contrasting in social stratification.[17] In this sense, our findings are quite unique in the literature.

This subsection conducts additional analysis to discuss whether background mechanisms function as expected. Here, note that our data availability is limited, and therefore, we are able to discover some backgrounds. Nonetheless, we present the available results to deepen the interpretations for our findings.

First, as an evidence of the negative effect related to work environments, we show that receiving a prize increases recipients' workload. We use the annual number of published books as the proxy for annual workload. We examine information on published books, because previous studies use publication information to investigate the effects of winning a prize on academicians' workload and job-career performance (Borjas and Doran, 2015; Chan et al.,

[17] Redelmeier and Singh (2001a, 2001b) report positive and negative relationships between receiving prizes and recipients' longevity, by using two types of datasets for the Academy Awards, actors/actresses and screenwriters. However, follow-up studies point out that the authors do not enough deal with the *immortal time bias*. Furthermore, the candidates' occupations differ between the datasets.

2014). We compile the annual number of published books before and after receiving a prize or the date of final nomination, subtract the former from the latter, and define the variable as the increased workload. We construct the dataset in a panel format and use the fixed-effects model for estimation, excluding unobservable time-invariant individual effects.

In Table 5, Panel A shows that the Akutagawa and Naoki Prizes increase the annual number of published books within several years of receiving the prizes. After receiving either prize, the recipients' workload increases more than that of nominees. In addition, we find that the size of the one-year effect is around two times larger for the Naoki Prize (2.552) than for the Akutagawa Prize (1.399). Recipients' increased annual workload is larger with the Naoki Prize. Furthermore, the Naoki Prize recipients annually publish 3.016 books before receiving the prize, and the increased annual workload is 0.75 for their unsuccessful nominees. That is, the Naoki Prize recipients need to publish six or more books annually after winning. If we consider workload to be positively correlated with working hours and that a considerable increase in working hours generates stress (Bannai and Tamakoshi, 2014; Kuroda and Yamamoto, 2016; Virtanen et al., 2011), the recipients particularly for the Naoki Prize feel greater stress.[18]

Second, as an evidence of the positive effect through improving economic conditions, we show that receiving a prize extends recipients' job-career longevity. Furthermore, we show that

[18] Previous literature did not find that the negative work-related effect may differ by social stratification or the other factors. However, this finding does not disturb our interpretation, because the interpretation is established at least when the negative effect exists for the Naoki Prize.

Table 5. Additional analysis (1)

Panel A. Effects of receiving a prize on increased annual workloads

	Increased annual workloads					
Fixed effects model estimation	**Within 1 year**	**2-3 years**	**3-5 years**	**5-10 years**	**10-15 years**	**15-20 years**
Akutagawa Prize winner:	1.399***	0.509**	0.871***	0.653	0.240	0.491
	(0.341)	(0.239)	(0.317)	(0.420)	(0.592)	(0.626)
Time-varying covariates variables:	Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:			1,346			
Number of observations:			363			
Naoki Prize winner:	2.552***	2.001***	2.631***	2.249***	1.365*	0.917
	(0.462)	(0.442)	(0.539)	(0.721)	(0.793)	(0.866)
Time-varying covariates variables:	Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:			1,901			
Number of observations:			345			

Notes for Panel A: (1) Robust standard errors in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) For the dependent variable, we compile the annual number of published books before and after receiving a prize or the date of final nomination, subtract the former from the latter, and define the variable as the increased annual workload. (4) Time-varying covariates are age, number of nominations, and number of other prizes. (5) To consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate.

Panel B. Effects of receiving a prize on job-career mortality

Probability-of-**job-career-death** equations with time-varying covariates	**Akutagawa Prize**			**Naoki Prize**		
Time-zero: date of first nomination	**A1**	**A2**	**A3**	**N1**	**N2**	**N3**
Akutagawa Prize winner:	0.817**	0.824**	0.844*			
	(0.077)	(0.077)	(0.083)			
Naoki Prize winner:				1.027	1.040	1.075
				(0.114)	(0.116)	(0.129)
Time-varying covariates variables:	Yes	Yes	Yes	Yes	Yes	Yes
Time-invarying covariates variables:	Yes	Yes	Yes	Yes	Yes	Yes
Suicide dummy variable:	No	Yes	Yes	No	Yes	Yes
Number of subjects:	363	363	328	345	345	329
Number of observations:	1,346	1,346	1,298	1,901	1,901	1,862

Notes for Panel B: (1) Robust standard errors (exponentiated form) in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) For the dependent variable, we collect information on publishing date for the most recent book, calculate the duration from the date of first nomination to the publication date, and define it as job-career duration. (4) We express estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100. (5) Time-varying covariates are age, number of nominations, number of published books, and number of other prizes. (6) Time-invarying covariates are birth year, winning rate when nominated, educational background, job other than a novelist, and a place of birth. (7) Records of some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record as a covariate. Also, to consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate. (8) The model with job-career mortality does not use time-dependent parameters, which is different from that with physical mortality, because our preliminary analysis confirms that the effects of receiving prizes on job-career mortality do not vary with time.

this extending effect is larger for the Akutagawa Prize than for the Naoki Prize. We define that the positive economic effect includes the effect of increasing recipients' great job opportunities and payment fees. These improvements would also have a positive impact on their job-career longevity. We collect information on publishing date for the most recent book, calculate the duration from the date of first nomination to the publication date, and define it as job-career duration.

Panel B shows that recipients of the Akutagawa Prize exhibit 15.6%–18.3% *lower* job-career mortality than fellow nominees during the study period.[19] Conversely, receiving the Naoki Prize does not have a statistically significant effect on recipients' job-career mortality. For the recipients, job-career durations are longer than those for the fellow nominees of the Akutagawa Prize, while they are indifferent for both in the case of the Naoki Prize. These results support our explanation that the positive economic effect is larger for the Akutagawa Prize than for the Naoki Prize.[20]

The above analyses indicate that the negative work-related effect exists particularly for the Naoki Prize, while the positive economic effect is strongly observed for the Akutagawa Prize. However, they do not identify the causes of such differences. This is possibly because the

[19] The model with job-career mortality does not use time-dependent parameters, which is different from that with physical mortality, because our preliminary analysis confirms that the effects of receiving prizes on job-career mortality do not vary with time.

[20] We assume that another positive effect through social comparisons is constant across social stratification. We recognize that empirically investigating this mechanism is important for our analysis because the candidates in our dataset are aware that they are being considered for the prize, and thus, a positive causal effect from winning the prizes to longevity could include discouragement felt by fellow nominees. Unfortunately, our data do not allow us to sufficiently test the existence and degree of this positive effect.

candidates for the Akutagawa Prize belong to the lower social stratum than those for the Naoki Prize or because the treatment effects themselves differ between the two prizes.

Finally, we discuss whether the heterogeneity in the positive economic effect across social stratification partly explains the difference in the effects of receiving a prize on longevity. We divide the Naoki Prize sample into the following two groups: one group comprises relatively new candidates in the Naoki Prize's sample and the other consists established ones. We consider the former group to resemble the Akutagawa Prize sample. And, we conduct survival analyses with physical mortality and job-career mortality. If the size of the positive economic effect depends on candidates' social stratum, we likely find a positive effect on physical longevity and job-career longevity from the former group or a negative effect on them from the latter.

The findings in Table 6 are consistent with our expectation. Panel A shows that receiving the Naoki Prize shortens physical longevity more strongly for well-established candidates. In contrast, we do not find such an effect for relatively new candidates. Panel B indicates that receiving the Naoki Prize extends job-career longevity rather for relatively new candidates, in particular the candidates who had no publication at their first nomination. These results backup our interpretation that the heterogeneity across social stratification at least partly explains the difference in the effects of receiving a prize on longevity.

Table 6. Additional analysis (2)

Panel A. Effects of receiving a prize on mortality (heterogeneity analysis)	**Naoki Prize**					
	Duration (years) b/w debut and 1st nomination		Number of publlished books at 1st nomination		Number of publlished books at 1st nomination	
Probability-of-death equations with time-varying covariates	< 3.2	>= 3.2	< 3	>= 3	0	>= 1
Time-zero: date of first nomination	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**
Naoki Prize winner:	1.598*	2.029***	1.275	1.693**	1.174	1.599**
	(0.412)	(0.545)	(0.344)	(0.388)	(0.529)	(0.308)
Time-varying covariates:	Yes	Yes	Yes	Yes	Yes	Yes
Time-invarying covariates:	Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:	172	173	152	193	72	273
Number of observations:	983	918	941	960	525	1,376

Panel B. Effects of receiving a prize on job-career mortality (heterogeneity analysis)	**Naoki Prize**					
	Duration (years) b/w debut and 1st nomination		Number of publlished books at 1st nomination		Number of publlished books at 1st nomination	
Probability-of-**job-career-death** equations with time-varying covariates	< 3.2	>= 3.2	< 3	>= 3	0	>= 1
Time-zero: date of first nomination	**N7**	**N8**	**N9**	**N10**	**N11**	**N12**
Naoki Prize winner:	0.850	1.176	0.768	1.250	0.413*	1.172
	(0.152)	(0.184)	(0.146)	(0.177)	(0.205)	(0.142)
Time-varying covariates:	Yes	Yes	Yes	Yes	Yes	Yes
Time-invarying covariates:	Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:	172	173	152	193	72	273
Number of observations:	983	918	941	960	525	1,376

Notes for Panels A and B: (1) Robust standard errors (exponentiated form) in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) For the dependent variable in Panel B, we collect information on publishing date for the most recent book, calculate the duration from the date of first nomination to the publication date, and define it as job-career duration. (4) We express estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100. (5) Time-varying covariates are age, number of nominations, number of published books, and number of other prizes. (6) Time-invarying covariates are birth year, winning rate when nominated, educational background, job other than a novelist, and a place of birth. (7) Records of some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record as a covariate. Also, to consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate. (8) The median in duration (years) between debut and 1st nomination is 3.2. And, the median in number of published books at 1st nomination is 3.

5. DISCUSSION AND CONCLUSIONS

Using datasets for Japan's Akutagawa and Naoki Prizes for literature, this study shows that receiving a prize has both positive and negative effects on longevity. The recipients of the Akutagawa Prize for new or emerging novelists live 1.4 years *longer* than fellow nominees, while those of the Naoki Prize mainly for established novelists live 5.2 *shorter* years than their fellow nominees. Our additional analyses indicate that we find a life-prolonging effect from receiving a prize when candidates belong to a lower social stratum. We discuss with empirical evidence that in this case, the positive effect through improving economic conditions is strengthened and the sum of the positive effects exceeds the negative effect related to work environments.

Our findings are unique, because they simultaneously show the existence of positive and negative net effects on longevity, by using two types of datasets that are identical in most aspects but contrasting in social stratification. Our academic contribution lies in providing a reasonable explanation of earlier studies, which show conflicting effects on longevity of receiving awards. Some studies find a positive but statistically insignificant effect from receiving Academy Awards for actors and actresses (Han et al., 2011; Sylvestre et al., 2006). This is possibly because the candidates include not only rookie actors and actresses but also experienced ones. Other studies highlight a negative effect from receiving the Academy Awards for screenwriters (Redelmeier and Singh, 2001b). Because the average age of the screenwriter recipients is higher

than that of the actor and actress recipients, many of the former tend to be well-experienced, and the positive economic effect could weaken. In addition, the occupational characteristics of screenwriters could cause winning awards to increase recipients' workload.

At a first glance, it is confusing that when using two unique types of datasets, the Nobel Prize and China's academician election, the authors find a positive and statistically significant effect from winning the prize (Liu et al., 2017; Rablen and Oswald, 2008). The candidates are well-established similar to those of the Naoki Prize, and thus we expected to find a negative net effect on longevity. One possibility is that winning these prizes might not increase recipients' workload. In the example for the Nobel Prize, the lags between the dates of achievement and recognition are large, and the recipients may have retired from active research at the time of recognition. In this case, both the positive economic effect and negative work-related effect is small, and the negative effect do not exceed the sum of the two positive effects. That is, we can interpret that their findings offer strong evidence for the existence of another positive effect through social comparisons.

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Appendix A.

We evaluate Akutagawa recipients' survival function (Table Appendix A). The reduction rate of their survival function is 0.07 (from 7,000 to 11,000 days), 0.28 (from 11,000 to 15,000 days), 0.02 (from 10,000 to 11,000 days), and 0.10 (from 11,000 to 12,000 days). That is, the reduction rate among the Akutagawa recipients sharply rises by 11,000 days after their first nomination.

Table Appendix A. Survival functions for recipients and fellow nominees (Table)

Akutagawa Prize							Naoki Prize						
Time, days	Beg. Total	Failures	**Survival function**	Standard error	95% confidence interval		Time, days	Beg. Total	Failures	**Survival function**	Standard error	95% confidence interval	
Recipients							**Recipients**						
5000	97	2	**0.98**	0.01	0.92	0.99	5000	100	8	**0.92**	0.03	0.85	0.96
6000	93	1	**0.97**	0.02	0.91	0.99	6000	94	3	**0.89**	0.03	0.82	0.94
7000	84	2	**0.95**	0.02	0.88	0.98	7000	86	3	**0.86**	0.03	0.78	0.92
8000	78	1	**0.94**	0.03	0.86	0.97	8000	82	2	**0.84**	0.04	0.76	0.90
9000	72	1	**0.92**	0.03	0.84	0.96	9000	73	4	**0.80**	0.04	0.71	0.87
10000	68	2	**0.90**	0.03	0.81	0.94	10000	60	8	**0.71**	0.05	0.60	0.79
11000	64	1	**0.88**	0.04	0.79	0.94	11000	55	3	**0.67**	0.05	0.57	0.76
12000	56	8	**0.77**	0.05	0.66	0.85	12000	47	8	**0.57**	0.05	0.46	0.67
13000	50	4	**0.71**	0.05	0.60	0.80	13000	33	10	**0.44**	0.05	0.34	0.55
14000	44	3	**0.67**	0.06	0.55	0.76	14000	28	4	**0.39**	0.05	0.28	0.49
15000	36	4	**0.60**	0.06	0.48	0.71	15000	26	2	**0.36**	0.05	0.26	0.46
Fellow nominees							**Fellow nominees**						
5000	202	25	**0.90**	0.02	0.85	0.93	5000	185	18	**0.92**	0.02	0.87	0.95
6000	194	2	**0.89**	0.02	0.84	0.92	6000	181	1	**0.91**	0.02	0.87	0.94
7000	189	3	**0.88**	0.02	0.83	0.91	7000	168	5	**0.89**	0.02	0.84	0.92
8000	177	8	**0.84**	0.02	0.78	0.88	8000	155	8	**0.84**	0.03	0.79	0.89
9000	164	8	**0.80**	0.03	0.74	0.85	9000	146	5	**0.82**	0.03	0.76	0.86
10000	153	7	**0.76**	0.03	0.70	0.82	10000	133	8	**0.77**	0.03	0.70	0.82
11000	142	2	**0.75**	0.03	0.69	0.81	11000	113	12	**0.70**	0.03	0.63	0.76
12000	125	10	**0.70**	0.03	0.63	0.76	12000	99	9	**0.64**	0.04	0.56	0.71
13000	108	10	**0.64**	0.03	0.57	0.70	13000	80	14	**0.55**	0.04	0.47	0.62
14000	97	7	**0.60**	0.04	0.53	0.66	14000	66	10	**0.48**	0.04	0.40	0.55
15000	94	3	**0.58**	0.04	0.51	0.65	15000	51	9	**0.41**	0.04	0.33	0.49

Note: Survival function is calculated over full data and evaluated at indicated timess; it is not calculated from aggregates shown at left.

Appendix B.

We re-measure survival from date of birth, investigating the effect of receiving a prize on mortality (Table Appendix B). We find even if the starting point is different, the implications are the same.

Table Appendix B. Effects of receiving a prize on mortality (Time-zero: date of birth)

Probability-of-death equations with time-varying covariates		Akutagawa Prize			Naoki Prize		
Time-zero: **date of birth**		**A1**	**A2**	**A3**	**N1**	**N2**	**N3**
Akutagawa Prize winner:		0.412**	0.398***	0.464**			
		(0.142)	(0.135)	(0.159)			
	After 65 years	3.168***	3.348***	2.844***			
		(1.227)	(1.276)	(1.107)			
Naoki Prize winner:					1.440**	1.469**	1.431**
					(0.235)	(0.242)	(0.242)
Time-varying covariates:	Age	0.986	0.985	0.996	1.004	1.004	1.009
		(0.015)	(0.015)	(0.017)	(0.014)	(0.014)	(0.014)
	Number of nominations (Akutagawa)	1.348***	1.347***	1.345***			
		(0.096)	(0.094)	(0.099)			
	Number of nominations (Naoki)				1.028	1.032	1.014
					(0.054)	(0.054)	(0.057)
	Number of published books	0.990	0.990	0.995	1.004	1.004	1.005
		(0.009)	(0.009)	(0.013)	(0.003)	(0.003)	(0.005)
	Number of other prizes	0.942	0.938	0.911	1.015	0.998	1.042
		(0.108)	(0.107)	(0.114)	(0.076)	(0.076)	(0.066)
	Suicide dummy		13.633***	19.040***		22.886***	19.462***
			(5.946)	(9.204)		(9.358)	(8.811)
Time-invarying covariates:		Yes	Yes	Yes	Yes	Yes	Yes
Number of subjects:		363	363	328	345	345	329
Number of observations:		1,413	1,413	1,364	1,901	1,901	1,862

Notes: (1) Robust standard errors (exponentiated form) in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) We express estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100. (4) Time-invarying covariates are birth year, winning rate when nominated, educational background, job other than a novelist, and a place of birth. (5) Records of some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record as a covariate. Also, to consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate. (6) When checking the time-dependency of the parameter among the Akutagawa recipients, we find that the reduction rate of the survival function sharply rises by 65 years after the first nomination. We find no change in reduction rate among Naoki recipients. (7) In columns A3 and N3, we use the subsample within the common support. We use information at first nomination to calculate the propensity score for winning a prize, and use the propensity score to construct the common support.

Appendix C.

Section 4.1 shows that receiving the Akutagawa Prize has a positive causal effect on longevity, whereas receiving the Naoki Prize has a negative effect on it. Some might argue that receiving the Akutagawa or Naoki Prize produces a differential effect, because we might fail to control unobserved factors, including unsuccessful nominees' expectations and candidates' talent and efforts, between the two prizes. For example, if the Akutagawa Prize assembles more talented and earnest candidates than the Naoki Prize, some differences could appear in the effects of receiving the prizes.

However, we found that several novelists nominated for the Akutagawa Prize were nominated or awarded the Naoki Prize. This supports that there is little difference in talent and efforts between candidates for the two prizes. Furthermore, we run another analysis, empirically dealing with the concern. The analysis is based on the assumption that candidates for both prizes are extracted from a common population. Concretely, we combine the datasets of the Akutagawa and Naoki Prizes, assume that every candidate can win either prize, and investigate the effect of receiving the Akutagawa or the Naoki Prize.[1] If the two prizes' candidates constitute different populations defined by unobserved factors, estimation results of receiving the prizes with the combined dataset can be inconsistent with those with each dataset.

When combining the datasets, we consider the following: as mentioned in Section 4.1,

[1] This analysis adds to the sample 44 new candidates nominated for both prizes.

unsuccessful nominees for the Akutagawa Prize cannot hope to receive it after becoming established authors, while unsuccessful nominees for the Naoki Prize can expect to receive it later, assuming their standing as established authors do not falter. There is a systemic difference between the two prizes in nominees' expectations of being re-nominated and eventually receiving them. To empirically consider the difference, we add to the model a variable denoting endorsements (letters, comments, feedback)[2] of review committees for nominees who did not receive the prize during previous selections. We assume that nominees with more endorsements have stronger expectations of receiving the prize eventually. After adding the covariate, candidates for both prizes plausibly become homogeneous (assuming equal talent and efforts).

In Table Appendix C, the model of Column 1 includes the variable that explains the number of letters reviewing nominees for the Naoki Prize only. This variable shows 0 for other candidates. Model 2 includes the variable that explains the number of letters reviewing nominees for both prizes.

The estimation results show that recipients of the Akutagawa Prize exhibit 52.9%–56.6% *lower* mortality than fellow nominees until 30 years after their first nomination. After 30 years, recipients' mortality becomes additionally 3.2 times *higher* than that of fellow nominees'. Conversely, recipients of the Naoki Prize exhibit 49.1%–52.4% *higher* mortality than fellow

[2] We collect number of letters in reviews from multiple sources (Kawaguchi, 2015a, 2015b; Bungeishunju Ltd., 1982-2002a, 2002b, 2002c, 2003a, 2003b).

nominees. We reject the null hypothesis that the first effect of receiving the Akutagawa Prize equals that of receiving the Naoki Prize, and we do so for the second effect of receiving the Akutagawa Prize. These results coincide with results in Section 4.1. This finding arrests the concern that we detect a positive effect from the Akutagawa Prize and a negative effect from the Naoki Prize because of unobserved factors between candidates for the two prizes.

Table Appendix C. Effects of receiving a prize on mortality (with the combined dataset)

Probability-of-death equations with time-varying covariates		**Akutagawa and Naoki Prizes**	
Time-zero: date of first nomination		**1**	**2**
Akutagawa Prize winner:		0.434**	0.471**
		(0.141)	(0.156)
	After 30 years	3.194***	3.217***
		(1.126)	(1.131)
Naoki Prize winner:		1.491**	1.524***
		(0.236)	(0.238)
Time-varying covariates:	Age	1.061***	1.062***
		(0.011)	(0.011)
	Number of nominations (Akutagawa)	1.022	1.004
		(0.058)	(0.057)
	Number of nominations (Naoki)	0.887**	0.899**
		(0.044)	(0.045)
	Number of published books	1.004	1.003
		(0.003)	(0.003)
	Number of other prizes	1.010	1.010
		(0.058)	(0.059)
	Number of letters in reviews	1.014	
	for fellow nominees (Only Naoki)	(0.012)	
	Number of letters in reviews		1.015
	for fellow nominees (Both)		(0.010)
Time-invarying covariates:		YES	
Number of subjects:		752	
Number of observations:		4,049	

Notes: (1) Robust standard errors (exponentiated form) in parentheses. The standard errors are clustered by novelist. (2) *** p<0.01, ** p<0.05, * p<0.1. (3) We express estimation results in hazard ratios. If the estimated value exceeds 1, mortality increases and vice-versa. We read a change in mortality as a percentage by subtracting 1 from the estimated value and then multiplying it by 100. (4) Time-invarying covariates are birth year, winning rate when nominated, educational background, job other than a novelist, and a place of birth. (5) Records of some novelists indicate only the year of birth or death. In these cases, we use January 1 as the date and add a dummy variable denoting no record as a covariate. Also, to consider a fixed effect for each prize period, we add a variable explaining the square root of the period number as a covariate. (6) When checking the time-dependency of the parameter among the Akutagawa recipients, we find that the reduction rate of the survival function sharply rises by 30 years after the first nomination. We find no change in reduction rate among Naoki recipients.

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