Superstition and risk-taking: Evidence from "zodiac year" beliefs in China

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Abstract

We show that superstitions –beliefs without scientific grounding – have material consequences for Chinese individuals' risk-taking behavior, using evidence from corporate and individual decisions, exploiting widely held beliefs in bad luck during one's "zodiac year." We first provide evidence on individual risk-avoidance. We show that insurance purchases are 4.6 percent higher in a customer's zodiac year, and using survey data we show that zodiac year respondents are 5 percent more likely to favor no-risk investments. Turning to corporate decision-making, we find that R&D and corporate acquisitions decline substantially in a chairman's zodiac year by 6 and 21 percent respectively.

1 Introduction

Many cultures have beliefs or practices – superstitions – that are held to affect outcomes in situations involving uncertainty. Despite having no scientific basis and no obvious function (beyond reducing the stresses of uncertainty), superstitions persist and are widespread in modern societies. It is clear that superstitions have at least superficial impact: for example, buildings often have no thirteenth floor, and airplanes have no thirteenth row, presumably because of Western superstitions surrounding the number 13. Whether these beliefs matter for outcomes with real stakes – and hence with implications for models of decision-making in substantively important economic settings – has only more recently been subject to rigorous empirical evaluation.

In our paper we study risk-taking of individuals as a function of birth year, and risk-taking by firms as a function of the birth year of their chairmen. We focus in particular on the twelve-year cycle in Chinese astrology, and the associated superstition that every twelfth year – one's "zodiac year of birth" – will bring bad luck. One attractive feature of this superstition, from an empirical design perspective, is that in any given year, a (random) twelfth of any given population will be in its zodiac year. This affords the possibility of looking at changes in behavior for an individual or firm, with non-zodiac-year firms or individuals serving as a natural benchmark.

We begin by looking at evidence from individual decision-making that allows us to relate zodiac year superstitions directly to risk aversion. . Our first piece of evidence links zodiac year superstitions to the stated risk aversion of respondents to the China Household Finance Survey in 2013. We see this as a useful starting point because stated risk preferences are less plausibly confounded by other factors that might influence risk-taking behaviors. We focus on the survey question in the CHFS investment module, which asks respondents the following: "What is your choice among combinations of risk and return?" Potential responses range on a 5-point scale from "High risk, high return" to "Unwilling to take any risk," with 47.8 percent choosing the no-risk option. We find that responses to this question – whether based on the 5-point scale or an indicator variable reflecting no risk tolerance – are predicted by whether the respondent is in his or her zodiac year.

For example, in specifications that use a rich set of individual controls, zodiac year respondents are 2.4 percentage points (about 5 percent) more likely to select no risk relative to other respondents.

We next look at individual-level decisions that have real financial consequences, using data from a large private insurance company. Using transaction-level data on all purchases that occur during 2005 – 2016 in two large Chinese cities (one in the north and the other in the south), we observe a small but discernable "zodiac year effect": purchases are 3 percent higher in a customer's zodiac year, and also in the year preceding it (as would be expected given the precautionary role of insurance), relative to other years. An event plot confirms that there is a distinct zodiac year increase, and the zodiac year effect is virtually unchanged in regression analyses that allow for year fixed effects as well as flexible age controls.

In the last part of the paper we present results on corporate investment as a function of a chairman's zodiac year. While the interpretation of these results may be complicated by many factors that influence corporate investment, they allow us to extend our analysis to a domain that potentially has very substantial economic implications. Furthermore, whereas superstitions can plausibly survive in small stakes individual decisions (much as noise traders can survive in equity markets), large corporate investments take place in a setting in which a combination of market competition, management discipline, and the advent of quantitative cost-benefit analyses should limit the effect of unprofitable traditional beliefs. We use data on publicly traded Chinese firms during 2007 – 2015, linked to information on their chairmen, to examine several measures of firm behavior that entail risk or (ex ante) uncertainty: R&D and corporate acquisitions, and leverage. (As we detail in Section 5, the chairman holds the greatest decision-making power in publicly traded corporations in China particularly since, in non-SOE firms, the chairman also holds a controlling stake in the firm; this is true for 89.8 percent of the chairmen in our sample.)

We find a clear and discrete drop in both R&D and acquisition activity in the chairman's zodiac year, but no impact on leverage. In our favored within-firm specification, R&D rates (R&D deflated by assets) are 6 percent percent lower (about 12 percent of the within-firm standard deviation) in

the chairman's zodiac year. In the within-firm specification, we find that the probability of a corporate acquisition is 4.2 percentage points lower (21 percent relative to the overall acquisition rate of about 20 percent). For both of these outcomes, we show in event plots that these declines are distinctly associated with the zodiac year. (We discuss in Section 5.2 why we might not observe any impact on leverage, related to a combination of stickiness and regulation of debt for Chinese corporations).

Overall, we take our results as highlighting an important role played by non-standard beliefs that have no obvious (present-day) functional purpose. We do so for settings that are consequential for both individual and organizational decisions.

While we are not the first to study how superstitions impact financial decision-making, we know of no prior work that explores how superstition impacts corporate investment, a setting in which one might assert, most strongly, that organizational and/or market discipline might limit the role of mistaken individual beliefs. Furthermore, because we are able to marshal evidence across a range of settings that implicate decision-makers of varying degrees of sophistication and geographies, for a range of decision types, our results collectively emphasize the ubiquity of impact of zodiac year superstitions on risk preferences.

A few recent papers look at the effect of superstitions on economically consequential decisions. The clearest precedent to our work is Hirshleifer et al. (2016), which studies the impact of Chinese numerology. They show that "unlucky" numbers are less common in Chinese IPO listings (and "lucky" numbers more common), and that these initial assignments lead to differences in IPO prices and subsequent returns. (Two other papers also look at the effect of numerological beliefs agents' decisions. Bhattacharya et al. (2018) show that numerological beliefs affect individual (but not institutional) stock traders' behavior in China, He et al. (2019) examine the impact of address numbers on the housing market in Singapore, and Bhattacharya et al. (ming) illustrate the spillover price effects of "haunted houses" in Hong Kong.) This work is, in turn, motivated by a rich literature in social psychology that documents individual and/or less consequential impacts of numerological

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beliefs (e.g., consumers pay more for "lucky" packages of 8 tennis balls (Block and Kramer (2009), and the luck of digits predict their use in consumer advertisements (Simmons and Schindler (2003)). While, as in our setting, the decision-makers in Hirshleifer et al are relatively sophisticated, there is evidence that scientific training or sophistication is uncorrelated with superstitious beliefs (e.g., Mowen and Carlson (2003)). Thus, it is plausible that, both in their setting and ours, paying a cost for superstitious beliefs may extend beyond the small-stakes "mistakes" such as overpaying for "lucky" tennis balls. Beyond encompassing a wide range of (economically important) settings, one additional helpful feature of focusing on zodiac year effects, rather than numerology, is that zodiac year is an attribute that varies both across individuals and across time for a given individual, which as we noted earlier, has advantages in empirically identifying the effect of superstition.

Beyond using the zodiac year phenomenon to study an under-explored aspect of risk preferences, we see our final set of results that focus on corporate decision-making as contributing to the extensive literature on the determinants of corporate innovation and risk-taking.Several papers look specifically at mergers and acquisitions as a means of reducing volatility in earnings (e.g., Acharya et al. (2011); Gormley and Matsa (2016)). While this would seem to be at odds with our findings, earlier work has focused on *ex post* risk, with diversifying acquisitions serving to reduce risk. Our emphasis is on the ex ante risk *during the chairman's zodiac year* that results from a signifiant corporate investment – i.e., an acquisition – with a relatively uncertain and speculative outcome.[1] By examining the link to R&D we also build on earlier work that uses this as a measure of risky investment; see, for example, Bargeron et al. (2010). (Some prior work examines leverage as an indication of risk-taking (e.g., Faccio et al. (2016)). As we will describe in greater detail, there are both regulatory and practical limitations on deleveraging in the Chinese context that make this means of reducing zodiac year risk less plausible.)

Finally, given our focus on corporate chairmen's zodiac years, our paper contributes to the corporate finance literature that emphasizes the role of leadership as influencing organizational decisions.

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[1]Indeed, it is well-documneted that diversification on avearge destroy firm values (see Berger and Ofek (1995) for a classic study on diversifiation discount) in the US setting.

See, most prominently, Bertrand and Schoar (2003), as well as the more recent contributions of Pan et al. (2017), Cain and McKeon (2016), and Roussanov and Savor (2014), which focus more specifically on leaders' attitudes toward risk .

In the next section, we provide a brief overview of the historical antecedents to zodiac year superstitions. The rest of the paper proceeds by presenting the data and results setting-by-setting, beginning with our results on corporate investment and risk-taking, followed by insurance purchases, and finally survey-based analyses on risk-return tradeoffs.

2   Zodiac year superstitions

The Chinese Zodiac, known as "Sheng Xiao", is based on a twelve-year cycle, with each year in that cycle related to an animal sign (rat, monkey, dragon, etc.). It is calculated according to Chinese lunar calendar, with its origins dating to astrological beliefs as far back as the Han Dynasty (202 BC – 220 AD). (For the sake of brevity, we do not provide details on the origin and evolution of these beliefs.)

The animal year when a person was born is called her Ben Ming Nian (Zodiac Year of Birth). Some birth years are considered to be luckier than others (in particular the year of the dragon is seen as lucky which, as demographers have observed, leads to a disproportionate number of births in dragon years; see, e.g., Goodkind (1991) and Yip et al. (2002)). Of more immediate relevance to our paper, years associated with one's birth animal ("zodiac years") are expected to bring bad luck (e.g., if you are born in the year of the dog, all dog years will be unlucky). Thus, every age that is a multiple of 12 is thought to bring bad fortune. (According to astrological traditions, individuals in their zodiac year may come in conflict with *Tai Sui*, also called the God of Age, a mysterious power or celestial body that controls people's fortunes. This conflict puts them at risk for misfortunes such as sickness, economic loss, physical injuries and career challenges. Thus one's zodiac year is also called the "Threshold Year" ("Kan Er Nian" in Chinese Pinyin), meaning that it is a year full of obstacles.)

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This "zodiac year" superstition is still taken seriously in China, and even individuals with modern beliefs are thought to avoid making major life changes during their zodiac year.[2] It is considered ill-advised to, for example, buy a house or get married during one's zodiac year, and considered prudent to avoid unlucky colors, numbers, or directions.[3] Of particular relevance for our setting, there are explicit admonitions against taking financial risks in one's zodiac year, and directives to weigh more carefully the downside of any possible investment.[4]

In the next three sections we present our results linking zodiac year superstitions to investments for three distinct domains and datasets. For ease of exposition, we divide our data description into three corresponding parts, paired with each set of results. We emphasize that while no single piece of evidence is dispositive, collectively our results make a strong case that zodiac superstitions have an economically significant impact on individual and organizational decisions.

3 Evidence from stated investment risk preferences

We begin by looking at individual-level survey responses on investment risk preferences. The results in this section rely on stated preferences rather than real-stakes decisions. As a starting point, however, one substantial advantage of this setting is that it is more straightforward to link responses directly to individual respondents' appetite for risk, without concern for the timing of decisions versus the timing of risks, an issue that will be arise in our analysis of insurance purchases, which protect against current as well as future risk. The focus on the individual also avoids complications introduced in relating individual preferences to organizational context, which we will necessarily consider when we look at chairman birth years and corporate outcomes in Section

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[2]We know of no scholarly work in English that details adherence to zodiac year superstitions. One Chinese language reference is Jingbo and Hua (2006). Additionally, there is a vast and ever-increasing volume of stories in the popular media describing the continued belief in zodiac year superstitions.

[3]There are also ways of mitigating zodiac year risks – the most popular solution is to wear red socks or underwear, often given as presents from elders at the beginning of the lunar year calendar, since the good luck associated with the color red may offset the unlucky effects of zodiac year ill fortune.

[4]For example, if one searches for "ben min nian" on Baidu Jingyan (roughly equivalent to quora.com), the top link (accessed May 29, 2019) has as its very first piece of advice to avoid large-scale or new types of investments (`https://jingyan.baidu.com/article/aa6a2c148c8dd40d4c19c4c9.html`. See also Jingbo and Hua (2006) and also Sun (2007) for more extensive discussions.

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3.1 China Household Finance Survey data

We use the most recently available round of data from the China Household Finance Survey (CHFS), administered in 2013.[5] The CHFS is, according to its English language website (`https://chfs.swufe.edu.cn/`), a "national survey, aimed at collecting micro-level information about household income, expenses, assets, liabilities, insurance and securities, etc. collects micro-level information about household financial and physical assets (housing and other property), debts and credit constraints, income, expenditures, social insurance, intergenerational transfer payments, demographics, employment, and payment history." The sampling is done at the household level. Our analysis is based on responses from the head of the household.

We focus on the subjective survey question on investment risk preferences, which the CHFS translates as, "What is your choice among combinations of risk and return?" Respondents are asked to provide a response on a 5-point scale ranging from "High risk, high return" (1) to "Unwilling to take any risk" (5), though the middle three categories describe only modest differences in risk preferences.[6] Nearly half of respondents (47.8 percent) who answered this question choose option 5.[7] We thus construct two variables, $InvRiskAversion$ which gives the respondent's answer on the 5 point scale, and $NoRisk$, which indicates that the respondent chose option 5.

Since 1949, China has used the (internationally accepted) Gregorian calendar, and it is on this basis that birth years are recorded in the CHFS (precise birth dates are not available). The mismatch between the Gregorian and Chinese calendars introduces some measurement error. In particular, since the Chinese new year begins sometime between late January and mid-February, respondents born early in the calendar year will be assigned to the "wrong" zodiac year. Most

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[5]The earlier round, administered in 2011, had fewer than a quarter as many respondents as the 2013 survey. Data from the 2015 and 2017 surveys were unavailable publicly at the time of writing.

[6]The middle category is "average risk, average return" whereas categories 2 and 4 are similarly worded, with the modifier "slightly above" (option 2) or "slightly below" (option 4) added to the description.

[7]257 (1.1 percent of the total) respondents did not answer this question.

plausibly, this leads to a bias toward zero as a result of classical measurement error. We return to this issue in greater detail in Section 5, as we will face similar (though less severe) measurement problems in our analysis of corporate risk-taking as our data include only birth month and year (but not birth day) of company chairmen.

Our age measure is simply 2013 minus the respondent's birth year. In addition to age, the survey collects rich demographic information on its respondents. In the specifications that follow, we may control for political affiliations (in particular Communist Party or Youth League membership), religion, marital and employment status, education, and gender. We may additionally control for 12-year age cohorts, centered around the zodiac year (i.e., $[19, 30], [31, 42]$, etc.), as well as age and its square.

We include in Table 1 summary statistics for the main variables in this analysis. We note that *NoRisk* has a mean of approximately 0.5, indicating that respondents expressed a relatively strong preference overall for no-risk investments. It is largely on this basis that we group other responses into a single category. There is a wide distribution of ages in the data, and as we will see in the next section, it will be important to control flexibly for this variable.

3.2   Results

We begin by showing the fraction of respondents for each age that have $NoRisk = 1$ in Figure 1. The graph lays bare the importance in controlling carefully for age (and assessing the sensitivity of our point estimates to age controls) in the analysis that follows: *Age* is a very strong predictor of *NoRisk*, and we aim to identify the zodiac year effect from deviations from the clear trend in risk preferences as a function of age.

Our main estimating equation is very similar to those of the preceding sections:

$$NoRisk_i = \beta \times Zodiac_i + f(Age_i) + Controls_i + \epsilon_i$$

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We present a range of specifications in Table 2. In column (1) we show the bivariate relationship between *Zodiac* and *NoRisk*. The coefficient of 0.024 (significant at the 5 percent level) implies a 5 percent higher rate of risk aversion (as captured by $NoRisk = 1$) in a respondent's zodiac year. Column (2) adds *Age* and Age^2 as covariates. As expected, the age terms are very highly significant. However, the coefficient on *Zodiac* is virtually unchanged, increasing slightly. Column (3) takes a different approach to controlling for age, including a spline with knots at each of 30, 42, and 54 (i.e., at the midpoint between zodiac years) as well as cohort fixed effects centered around zodiac years. Again, the point estimate on *Zodiac* is largely unaffected. We add our full set of controls in column (4), including gender and employment status, as well as fixed effects for political and religious affiliations, educational attainment, and marital status.[8] Again the coefficient on *NoRisk* is largely unchanged. As a final approach to assessing the sensitivity of our results to age controls, we present the results of specifications with full controls, and the sample limited to ages in relatively narrow bands around zodiac years. In columns (5) – (7) we show results based on $[-3, +3]$, $[-2, +2]$, and $[-1, +1]$ bands respectively. The point estimates are quite stable, and significant at the 5 percent level in the first two models, and at the 10 percent level in the final variant (which has only about a quarter the number of observations as the full sample).

In Appendix Table A1, we present results which parallel those in Table 2, using *InvRiskAversion* as the outcome variable. The results are somewhat more fragile – without age controls (column (1)), the bivariate relationship is not statistically significant ($p = 0.11$); while the coefficient is stable across specifications, it is statistically insignificant in the smaller samples in columns (5) – (7).

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[8]We used quadratic age controls in this specification, but in practice the point estimates are virtually identical if we use cohort dummies and a spline.

4 Evidence from insurance purchases

We now extend our analysis of the role of zodiac year superstitions in individual decision-making to examine economically consequential decisions, rather than survey responses. In particular, we analyze the role of zodiac year superstitions on the timing of individuals' insurance purchases, using the sales database of a large private insurance company, which lists all purchases made by residents of two very large cities in China.We note at the outset that precautionary behavior would more naturally predict insurance purchases before one's unlucky year begins. In our regression specifications, and the event plots we show, we measure separately whether there is an increased probability of insurance purchases in the customer's zodiac year, as well as in the year prior.

4.1 Data on Insurance Purchases

We obtained data from one of China's largest insurers, on the policies purchased by all customers in two very large cities – one in the north and the other in the south of the country – during the years $2005 - 2016$.[9] The policies covered include medical, life, and accident insurance. Across the two cities, we have data on a total of 1,461,855 customers. The median customer purchased insurance in just one year in our sample. There is a non-trivial number of repeat purchasers, however – the mean number of years in which a customer purchased insurance is 1.27. It is also quite common for individuals to purchase multiple plans (e.g., medical and auto insurance simultaneously) – conditional on purchasing insurance in a given year, the mean number of plans purchased is 1.50.

Since we have the precise date that a policy was purchased, we may straightforwardly generate the variable $Insurance_{iy}$ to denote that individual i purchased at least one insurance contract in Chinese lunar year y. Using the precise birth date of each policyholder, we may similarly construct a variable to denote that year y is the policyholder's zodiac year, $Zodiac_{iy}$, and the individual-level control, Age_{iy}. (We do not report separate summary statistics for these data, since we have data

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[9]2005 is the most recent year that the data are available, and the company did not wish to share non-historical data (i.e., for 2017-18). Nonetheless we view the sample window we were provided as fortuitous, as it comprises a full 12 year zodiac cycle.

only on the dates of birth and insurance purchases for customers. We include the mean of insurance purchases, the dependent variable, in the regression table below.)

4.2 Results

Our analysis is done on the customer-year dataset in which the outcome is whether customer i purchases insurance in year y as a function of birth year:

$$Insurance_{iy} = \beta_1 \times Zodiac_{iy} + \beta_2 \times Zodiac_{iy-1} + f(Age_{iy}) + \gamma_y + \omega_i + \epsilon_{iy}$$

In addition to year and customer fixed effects, we will include quadratic controls for age in some specifications. As noted at the beginning of this section, precautionary motives may lead to purchases also in the period leading up to a customer's zodiac year, which is why we include lagged zodiac year ($Zodiac_{iy-1}$) as a covariate as well. If individuals subscribe to zodiac year superstitions, we conjecture that $\beta_1, \beta_2 > 0$. Throughout, standard errors are clustered at the level of the individual customer i.

As in the preceding section, we first illustrate the patterns in our data via an event plot which shows the fraction of customers purchasing insurance as a function of years relative to zodiac year ($y = 0$). Intriguingly, the graph shown in Figure 2 reaches a peak at $y = -1$, as would be predicted by a model of precautionary insurance motives, and remains elevated at $y = 0$. Insurance purchases are distinctly more likely in these two years relative to others in the twelve year lunar cycle.

In Table 3 we present our regression results, which shows that the zodiac year effect is statistically robust and largely invariant to the introduction of age controls. Throughout we multiply the coefficient on *Zodiac* by 1,000 to make it easier to read the table. In column (1) we show a specification including only *Zodiac* and its lags as well as year fixed effects.[10] The coefficients on both *Zodiac* variables are significant at the 0.1 percent level. The estimates of β_1 and β_2 (4.91 and 4.82 respectively) imply a 4.6 percent higher rate of insurance purchases in a customer's zodiac

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[10]The results are virtually identical if we include individual fixed effects.

year as well as the year prior.[11] When we add quadratic controls for age in column (2) it has only a modest effect on the estimated coefficients. Column (3) controls for age via a spline with knots at each of 30, 42, and 54 (i.e., at the midpoint between zodiac years) as well as cohort fixed effects centered around zodiac years; the implied zodiac year effect is marginally larger than in specifications with less flexible controls. Finally, in columns (4) and (5) we show the estimates for the "north" and "south" cities separately. Both show a zodiac year effect though the estimates are quite a bit higher for the southern city.

In summary, we observe a small but clearly discernable zodiac year effect in insurance purchases, which is consistent with individuals attempting to mitigate perceived higher risk during zodiac years, and indeed anticipating this risk by preemptively purchasing insurance in the preceding year.

5 Evidence on corporate risk-taking

Our final set of evidence examines corporate investment, which is of first-order economic consequence, and takes place in a setting in which one might expect that "rationalizing" forces would be most likely to limit the role of individual superstitions.We focus specifically on investments that, ex ante, have relatively uncertain future payoffs, in particular R&D and corporate acquisitions.

We show that R&D as well as corporate acquisitions are lower in the chairman's zodiac year. [12] (In results included in appendix tables, we will look at other outcome variables – including leverage – and show that none others are correlated with the chairman's zodiac year.)

5.1 Data on firms and their chairmen

Our main sample is comprised of all non-state-owned firms (referred to below as non-SOEs) listed on the Shanghai and Shenzhen Stock Exchanges during the years 2007-2015. The start date is dictated

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[11]If we include only *Zodiac* or only its lag the estimated coefficient is naturally a bit smaller (though still significant at the 0.1 percent level), since the observations from the other group are included as a "control" year.

[12]These two findings are perhaps all the more surprising since these variables – R&D and acquisitions – have a negative within-firm correlation.

by the fact that listed firms have only been required to report (annual) R&D information (one of our main outcome variables) in their financial statements since 2007. We omit from our analysis financially distressed firms (that is, so-called special treatment (*ST and ST)), which account for 2.9% of the total sample. [13]

Financial statements and information on each chairman's birth year (as well as education and gender) are obtained from CSMAR, a Shenzhen-based financial data vendor. All Chinese listed firms use the same fiscal year period, based on the Gregorian calendar (i..e, starting on January 1 and ending on December 31).

We focus on the chairman (and his zodiac year) as important for the firm's decisions for two related reasons. First, for non-SOEs, the chairman is generally the ultimate controller of the firm (this is true in 89.8 percent of the firms in our sample).[14] The controller is the firm's largest shareholder which, even if its stake falls short of the 50 percent threshold, is by law the highest decision-making authority in the organization. Second, the chairman generally serves as ultimate decision-maker on major strategic decisions, including (but not limited to) mergers and acquisitions as well as investment allocations. CEOs, by contrast, manage daily business operations.[15]

Using the CSMAR data, we create our main outcome variables: (1) *R&D*, defined as total R&D expenditure t, divided by total assets in year $t-1$; and (2) *Acquisition*, an indicator variables which denotes that the firm was involved with at least one M&A transaction in that year. The CSMAR data include information on all announcements of M&A deals for Chinese listed firms. The specific

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[13]According to regulations in China, if a firm has 2 consecutive years' negative profits, ST is added as a prefix to its name abbreviation to warn investors about substantial risk (for example, instead of being listed as ChangSheng, the firm is listed as ST ChangSheng). If an ST firm experiences a third year negative net profits, then an asterisk is further added as a prefix to its abbreviated name (i.e., *ST ChangSheng), to alert potential investors to the fact that the company is very close to being delisted. Perhaps unsurprisingly given that special treatment firms are a very small fraction of the overall sample, our results are virtually identical if we do not drop them. However, the specific example we give, ChangSheng, is illustrative of the turmoil that special treatment companies often face, which motivates our exclusion criterion. ChangSheng is a biotech company that was listed on the Shenzhen exchange, but flagged for special treatment in July 2018 after receiving a billion-dollar fine for falsifying data and selling defective vaccines. As is common with ST firms, ChangShen was subsequently delisted, in December 2018.

[14]We do not have information on the controller's birth year in the 10 percent of cases that he/she is not also the chairman.

[15]See http://finance.sina.com.cn/leadership/20120106/145311144355.shtml for survey evidence on this division of roles. According to the survey, the chairman often intervenes even in daily business operations, such that the CEO overall does little more that carry out the chairman's wishes.

announcement dates are recorded, and we use this information to code whether there was an M&A deal in a given Chinese lunar calendar year.

We also use the financial data from CSMAR to define a range of additional firm-level control variables: *CashRatio* defined as total cash and cash equivalents in year t divided by total assets in year $t - 1$; *TobinsQ*, available directly from CSMAR, is (year-end) total market value of equity plus book value of debt, divided by total assets; *Leverage* is the ratio of total liabilities to total assets in year t. Finally, based on the identity of its controller, we classify each firm as a state-owned enterprise (SOE) or private firm.

As noted earlier, since 1949, China has used the Gregorian calendar, and it is on this basis that ages are recorded in CSMAR. Since the data include only birth year and birth month (i.e., not the day of the month) we need to account for the mismatch between the Gregorian and Chinese calendars. Since the Chinese new year begins sometime between late January and mid-February, we assign chairmen born in January to the previous year's animal (e.g., a chairman born in January 1971 will be assigned to the Year of the Dog, which ended on February 6, 1971, whereas a chairman born in February 1971 will be assigned to the Year of the Pig, which is the animal for the following year). This will create some mismeasurement in assigning zodiac years to chairmen with January and February birthdays, and as a result, we expect, a bias toward zero in our estimates. Consistent with this, when we omit all observations with January and February birthdays from the sample, our point estimates are marginally larger (i.e., more negative). Finally, using CSMAR's Corporate Governance database, we obtain information on the chairman's gender and highest level of educational attainment.

We present summary statistics for all chairman and company data in Table 4. In the left panel (Panel A) we show summary statistics for the full sample. In the right panel (Panel B) we present separate summary statistics for $Zodiac = 0$ and $Zodiac = 1$ observations, as well as their difference. Most notably, there are no significant differences in any variables other than *R&D* and *Acquisitions*. The difference in the case of *R&D* is -0.23 percent (significant at the 5 percent level), about 10

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percent of the sample mean, while the difference in *Acquisition* is -4.8 (significant at the 1 percent level). We note finally that the table includes non-winsorized values of all variables. There are some extreme outliers for *R&D* and also some control variables: for example, the mean of *R&D* is 2.1 whereas the median is only 1.4, indicating some right skewness. In all of our main analyses we will use winsorized (at the 1 percent level) values of all continuous variables, presenting results with non-winsorized data as robustness checks.

5.2 Results

Before turning to our regression analyses in this section, we present "event plots" in Figures 3 and 4 which show the mean values of *R&D* and *Acquisition* in the [-3,+3] window around a chairman's zodiac year. In both cases, there is a distinct drop in the zodiac year relative to other years, which provides some indication that the zodiac year effect we observe in our regression specifications is not the result of other time trends (e.g., related to chairman age) in the data.

We now turn to our basic regression specification, which is given by

$$Outcome_{fy} = Zodiac_{C(fy)} + \gamma_y + \omega_f + ChairmanControls_{C(fy)} + FirmControls_{fy} + \epsilon_{fy}$$

where *Outcome* is, depending on the specification, *R&D* or *Acquisition*. *Zodiac* denotes that y is the zodiac year of chairman C of firm f. We include in all specifications fixed effects for year γ_y and for firm ω_f. Firm-year controls include the logarithm of the book value of assets, cash, leverage, Tobin's Q, and chairman controls include age, education, and gender.

We present the results of this specification for our sample of 1783 non-SOE firms in Table 5. In the first column, we include only *Zodiac* as a covariate; its coefficient is -0.144 (significant at the 5 percent level), about 15 percent of the within-firm standard deviation in R&D expenditure, or about 10 percent of the (winsorized) sample mean. We add progressively more controls, including firm and year fixed effects (column (2)), chairman controls (column (3)), firm controls (column (4)),

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and a combination of age cohort fixed effects and spline variables (column (5)).[16] The coefficient on *Zodiac* is quite stable across specifications. In column (6) we use the one year lead and one year lag of *Zodiac* as covariates additional. This can be seen as a placebo test and also allows us to assess the extent to which the zodiac year effect simply involves the intertemporal substitution of R&D to the years before and after the chairman's zodiac year. In contrast to the preceding specifications, having a zodiac year in the subsequent or prior year to y has no significant correlation with $R\&D_{fy}$. We can reject at the 5 percent level that the coefficient on *Zodiac* is equal to the average of its lead and lag. It is perhaps of note that - while not approaching significance - the coefficient on the lag of *Zodiac* is negative, possibly indicating precautionary motives, given the lag between R&D investment and any ultimate payoff. Finally, in column (7), we show the results using non-winsorized data, and observe that the implied zodiac year effect is marginally higher both in terms of significance and magnitude.

We repeat this exercise for *Acquisitions* in Table 6. To make the coefficients in this table more readily comparable to those of the R&D analyses, we multiply the outcome variable by 100. Again, there is a distinct zodiac year effect, significant at the 1 percent level across all specifications. The implied magnitude is very large. The non-zodiac-year mean acquisition rate is 19.7 percent, so that the coefficient of 4.2 percent in our preferred specification (in column (4)) implies that the probability of an acquisition is 21 percent lower in zodiac years. (Again, the lag and lead of *Zodiac* are uncorrelated with acquisitions, arguing against a simple intertemporal substitution around the chairman's zodiac year.)

In Appendix Tables A2 and A3, we show a placebo test, focused on state-controlled firms. In contrast to non-SOE firms, where the chairman generally represents his own financial interests as controlling shareholder, in SOEs the chairman represents the interests of (and takes instructions from) the government. Indeed, in a very tangible sense, the M&A activities we study are strictly controlled by the government via the State-owned Assets Supervision and Administration Commis-

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[16]The sample size falls in column (4) because market-to-book is missing for 362 firm-year observations, primarily because of an absence of active stock trading, leading to missing values for market valuation.

sion (SASAC), a body created by China's State Council in 2003 to oversee the decisions of SOEs. Regulations passed in May 2004 explicitly specify that the transfer of state ownership stakes (which is a part of most M&A activity by SOEs) must be approved by the local SASAC office as well as the local government.[17] Even for regular CAPEX investment, it is typical for local governments as well as local SASAC offices to set up rules governing SOE investment to maintain tight control over firms' strategic decisions.[18] Firms owned by the central government are even more directly controlled by SASAC regulations, which stipulate that any diversified investments (i.e., investment not in the firm's main line of business) require approval. Additionally, these firms must submit annual investment plans to the SASAC for feedback and guidance.[19,20] In summary, the chairman of an SOE serves more of a custodial role in carrying out government wishes, and hence we assert that his personal characteristics (including zodiac year status) are less plausibly relevant for firms' investment decisions. Consistent with this view, we find no correlation between SOE chairmen's zodiac year status and firms' R&D and M&A investments, as shown in Tables A1 and A2.

Finally, in Appendix Tables A4 – A5 we present a series of further extensions to probe the consistency and robustness of our results. In Table A4, we allow for chairman fixed effects (columns (1) and (3)) and find our results are largely unaffected (indeed, the estimated effects marginally increase); we also include the CEO's zodiac year as a covariate (columns (2) and (4)) and observe that, as expected, it is uncorrelated with either R&D or acquisitions.

Table A5 examines other outcomes – namely market valuation (Tobin's Q) and leverage. Plausibly, particularly for firms facing uncertain cash flow, leverage might be seen as a marker for risk

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[17]See in particular Article 23 of Section 4. The full English text of these regulations may be found at `http://en.sasac.gov.cn/2003/11/24/c_118.htm` (last accessed February 10, 2019).

[18]See, for example, `http://www.tl.gov.cn/zxzx/xwzx/136/201807/t20180731_448570.html` (last accessed February 10, 2019) for rules governing SOE investment for firms in Tongling City (population 1.7 million in 2017). The rules specify that investment must be approved by the local SASAC office, and then require a further layer of approval from the prefecture administration.

[19]See `http://www.lehmanlaw.com/newsletter/CentralEnterprisesJune282006.pdf` (last accessed February 10, 2019) for an English translation of the relevant regulations. See in particular Article 9.

[20]In 2017, after our sample period ends, the State Council began to relax SASAC and government regulations on M&A, restructuring, and IPOs by SOEs, through its "Notice of the General Office of the State Council on Forwarding the Plan of the SASAC for Promoting the Transformation of Functions with the Focus Put on Capital Management (No. 38 [2017])" The full Chinese text is available at `http://www.gov.cn/zhengce/content/2017-05/10/content_5192390.htm` (accessed on Feb 11, 2019).

(see, e.g., Koudijs and Voth (2016) and Faccio et al. (2016) for references) . We find no correlation with the chairman's zodiac year in either case, however.This is consistent with our prior expectations. Capital structure is remarkably stable and persistent over time within the same firm, and when the firm does change its capital structure, it adjust slowly towards its target ratio, possibly due to adjustment costs (see Fama and French (2002) and Lemmon et al. (2008) for references). In the Chinese context, deleveraging is further complicated by constraints imposed by policymakers, who wish to maintain high growth for political reasons.[21]

Finally, in Table A6, we consider whether chairman sophistication (as captured by college education, or overseas education) and governance (as captured by ownership concentration or CEO/chairman dual role) affect the estimated relationship between *Zodiac* and risk-taking. We do not find any substantial heterogeneity. As we noted in Section 2, even well-educated Chinese seem to subscribe to zodiac year superstitions, which makes the lack of any heterogeneity in the estimated relationship unsurprising.

6   Conclusion

We show that astrological superstitions – in particular belief in bad luck during one's zodiac year – affect decision-making under uncertainty in a range of settings. We include results on individual preferences and decisions, which provide more direct evidence on the impact of zodiac year superstitions on risk-taking. We complement these findings with analyses of corporate investment, where we find that the chairman's zodiac year is associated with lower R&D investment and reduced M&A activity.

Our results emphasize the role of non-standard beliefs in influencing important decisions at the individual- and organizational-level, and in particular our findings on corporate investment also

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[21]See, for example, the following post and links therein, which emphasize bureaucrats' concerns for that delevering may slow economic growth and lead to instability: `https://www.moneyandbanking.com/commentary/2017/7/9/` `china-deleveraging-is-hard-to-do`. A further discussion of the tradeoffs between growth and leverage is provided in `http://www.xinhuanet.com//english/2017-07/09/c_136430117.htm`.

emphasize the potential consequences of leaders' beliefs on decision-making that affect corporate structure and innovation. While the role of chairman is vested with particularly strong decision-making power in listed Chinese companies, other research (see especially Bertrand and Schoar (2003)) suggests that the preferences and beliefs (including superstitions and/or other biases) of business leaders may be relevant in other corporate governance settings.

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Figure 1: Relationship between CHFS respondent age and investment risk preferences
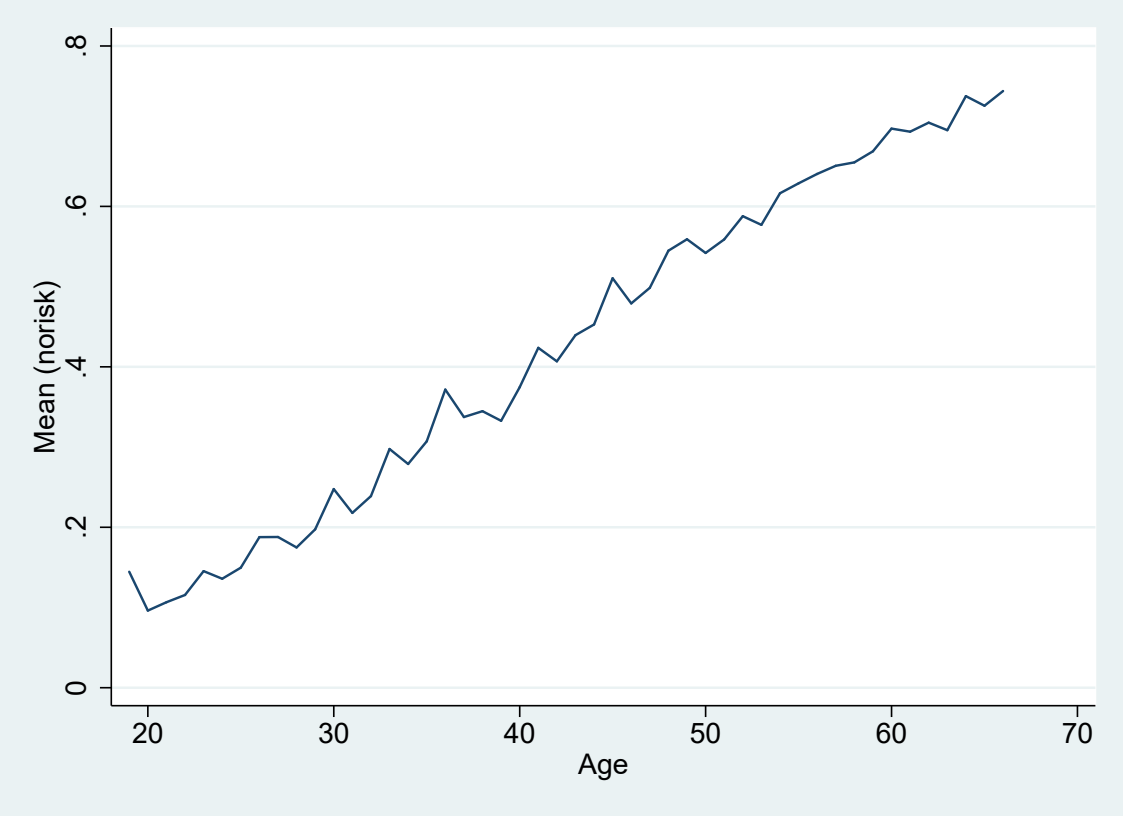
Notes: This figure shows the fraction of (head of household) respondents from the China Household Finance Survey 2013 who stated that they prefer investments with no risk, as a function of age in 2013.

Figure 2: Event plot of insurance purchases as a function of years relative to zodiac year (y=0)
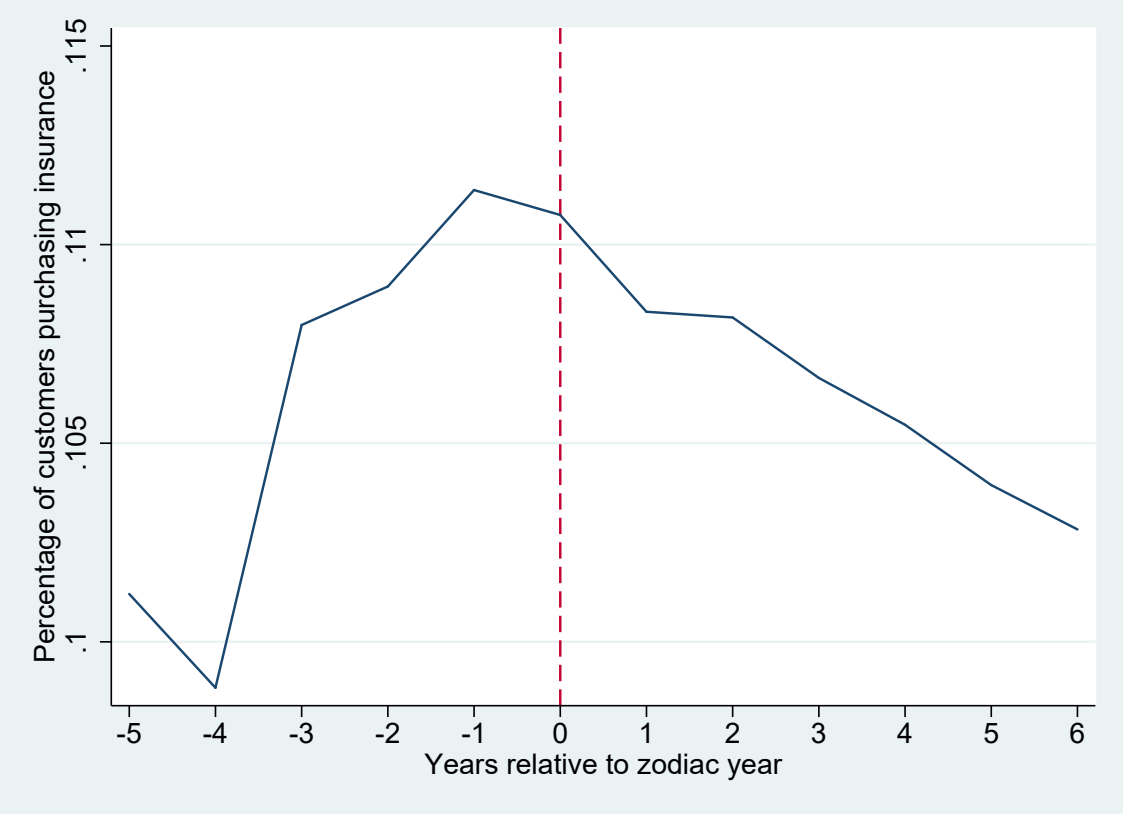
Notes: This figure shows the fraction of individuals buying insurance as a function of birth year, relative to the individual's zodiac year (y=0). The data come from a large Chinese insurance company, and covers all customers in two large cities, one in northern China and the other in the south, for the years 2005–16. The data used to construct this figure are at the customer-year level.

Figure 3: Event plot illustrating the relationship between chairman zodiac year and R&D invest-ment
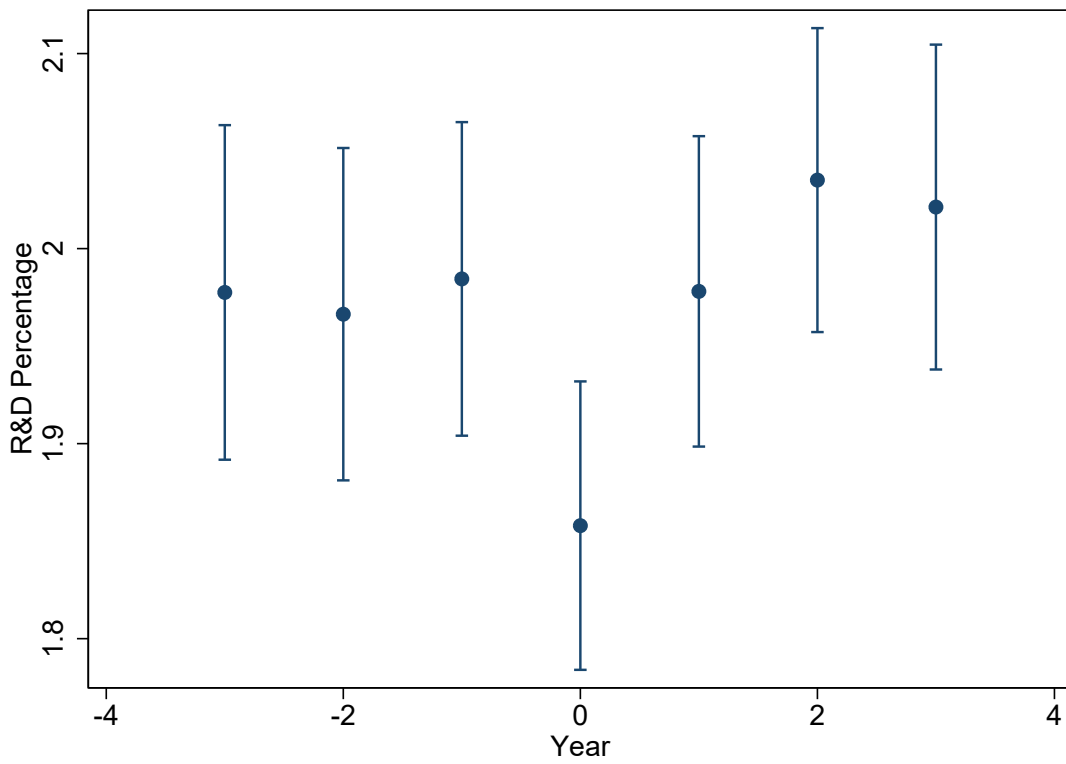
Notes: This figure shows the mean value of R&D for non-SOE firms listed on the Shanghai and Shenzhen stock exchanges, for the years 2007–2015, as a function of the chairman's zodiac year. The horizontal axis reflects years relative to the chairman's zodiac year. The markers at each year reflect the mean value of R&D as a percentage of (lagged) assets, and the "whiskers" denote 95 percent confidence intervals.

Figure 4: Event plot illustrating the relationship between chairman zodiac year and M&A activity
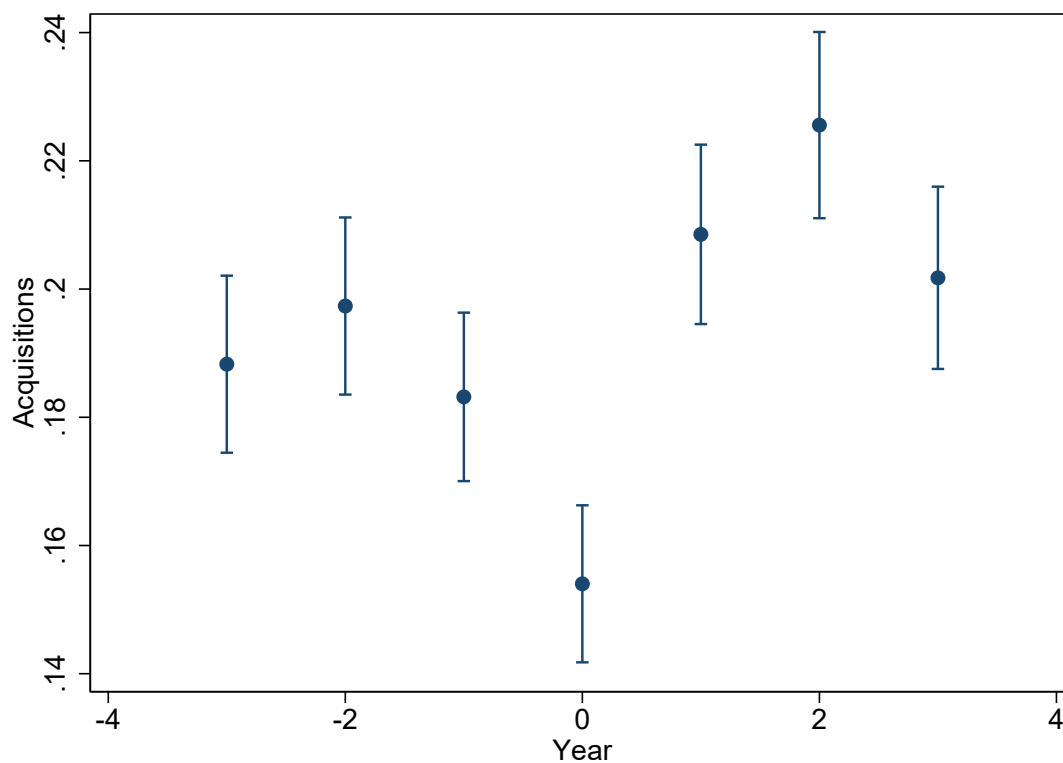
Notes: This figure shows the mean fraction of firms engaging in M&A activity, for non-SOE firms listed on the Shanghai and Shenzhen stock exchanges, for the years 2007–2015, as a function of the chairman's zodiac year. The horizontal axis reflects years relative to the chairman's zodiac year. The markers at each year reflect the mean value of the fraction of firms engaging in M&A activity in a given year, and the "whiskers" denote 95 percent confidence intervals.

Table 1: Summary statistics for risk preference survey data

Varible Name	Mean	StdDev	Observations
NoRisk	0.483	0.500	23674
Zodiac	0.089	0.285	23931
Age	46.339	11.817	23931
Employed	0.694	0.461	23931
Female	0.480	0.500	23931

Notes: $NoRisk$ is an indicator variable denoting that the respondent expressed a preference for investments without any risk associated with them. $Zodiac$ is an indicator variable denoting that the respondent was in his or her zodiac year at the time of the interview (based on the Gregorian calendar). Age, $Employed$, and $Female$ are all self-explanatory. Other control variables include the categorical variables listed in the notes to Table 2. See text for additional details.

Table 2: Relationship between CHFS respondent zodiac year and investment risk preferences

	Dependent variable: NoRisk						
	Full Sample				±3 years	±2 years	±1 years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	0.024**	0.025**	0.024**	0.024**	0.024**	0.025**	0.022*
	(0.0114)	(0.0106)	(0.0106)	(0.0105)	(0.0108)	(0.0112)	(0.0122)
Age		0.020***		0.014***	0.013***	0.012***	0.014***
		(0.00168)		(0.00210)	(0.00286)	(0.00342)	(0.00439)
Age^2		-0.000***		-0.000	-0.000	0.000	-0.000
		(0.0000190)		(0.0000229)	(0.0000317)	(0.0000380)	(0.0000489)
Female				0.082***	0.081***	0.075***	0.072***
				(0.00628)	(0.00806)	(0.00946)	(0.0120)
Employed				-0.029***	-0.015	-0.017	-0.023*
				(0.00720)	(0.00922)	(0.0109)	(0.0138)
Age cohort FE and spline	No	No	Yes	No	No	No	No
Personal background FE	No	No	No	Yes	Yes	Yes	Yes
Mean of the D.V.	0.483	0.483	0.483	0.483	0.486	0.487	0.491
Adjusted R^2	0.000	0.125	0.125	0.161	0.157	0.162	0.163
Number of observations	23674	23674	23674	23672	14384	10334	6285

Notes: This table shows, using data from the China Household Finance Survey 2013, the relationship between a respondent's birth year and his response to the question, "What is your choice among combinations of risk and return?" The dependent variable, NoRisk, is an indicator variable denoting the choice, "Unwilling to take any risk." Zodiac is an indicator variable denoting that, in 2013, the respondents age was a multiple of 12. Columns (4) - (7) include, in addition to basic demographic controls, fixed effects for political status, educational attainment, religion, and marital status. The other variables definitions are self-explanatory. Columns (5) - (7) limit the sample to individuals whose in 2013 is within 3, 2, and 1 years of their zodiac year respectively. See text for details on variable definitions and construction. Robust standard errors in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table 3: Relationship between individual's zodiac year and insurance purchases

	Dependent variable: Insurance Dummy				
	(1)	(2)	(3)	(4)	(5)
Zodiac/1000	4.912***	4.942***	6.602***	3.523***	6.602***
	(0.279)	(0.278)	(0.278)	(0.389)	(0.396)
Zodiac (lagged)/1000	4.816***	4.804***	6.412***	3.032***	6.570***
	(0.279)	(0.279)	(0.280)	(0.390)	(0.397)
log(Age)		0.859***		0.889***	0.770***
		(0.002)		(0.003)	(0.002)
$[log(Age)]^2$		-0.117***		-0.121***	-0.106***
		(0.000)		(0.000)	(0.000)
Constant	0.105***	-1.455***	-0.112***	-1.514***	-1.291***
	(0.000)	(0.004)	(0.001)	(0.006)	(0.004)
Mean of the D.V.	0.106	0.106	0.104	0.108	0.106
Individual and year fixed effects	yes	yes	yes	yes	yes
Age Cohort FE and spline	no	no	yes	no	no
Sample	Full	Full	Full	North	South
Observations	17,542,260	17,542,260	17,542,260	8,935,200	8,607,060
Adjusted R-squared	0.014	0.017	0.018	0.026	0.015

Notes: This table shows the relationship between an individual's birth year and insurance purchases. The data come from a large Chinese insurance company, and covers all customers in two large cities, one in northern China and the other in the south, for the years 2005-16. The analysis is at the customer-year level. The outcome, Insurance, is an indicator variable denoting that a customer bought at least one insurance product that year. Zodiac is an indicator variable denoting that it is the customer's zodiac year. All other variables are self-explanatory. See text for details on variable definitions and construction. Standard errors, clustered at the customer-level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table 4: Summary statistics for zodiac year and corporate investment

	Panel A: Full Sample				Panel B: Balance		
	Obs	Mean	St.D	Median	Zodiac=0	Zodiac=1	Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(6)-(5)
Zodiac	9893	0.0879	0.2832	0.0000			
Chairman characteristics:							
Education	9373	2.0581	0.9824	2.0000			
Age	9373	50.5664	7.8344	50.0000			
Female	9361	0.0492	0.2164	0.0000			
Firm-year characteristics:							
R&D	9372	2.0935	3.0879	1.3866	2.1145	1.8879	-0.2267**
					(0.0342)	(0.0795)	(0.1099)
Acquisition	9373	19.7482	39.8120	0.0000	20.1929	15.4023	-4.7906***
					(0.4354)	(1.2245)	(1.4163)
log(Assets)	9373	21.3454	1.1012	21.2597	21.3426	21.3728	0.0302
					(0.0119)	(0.0378)	(0.0392)
Leverage	9373	47.3959	187.2180	36.8849	47.5631	45.7615	-1.8016
					(2.1068)	(3.1748)	(6.6644)
PctCash	9364	0.3402	0.6714	0.1905	0.3395	0.3473	0.0078
					(0.0074)	(0.0185)	(0.0239)
Tobins Q	8802	3.1875	11.7472	2.1128	3.2270	2.8036	-0.4234
					(0.1377)	(0.0967)	(0.4306)

 Notes: This table is based on firm and chairman characteristics for all non-SOE firms traded on the Shanghai and Shenzhen exchanges during $2007 - 2015$. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year characteristics R&D, the percentage of research and development expenditures to lagged assets; Acquisition, an indicator variable denoting M&A activity; log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firms assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. See text for further details. The last three columns provide mean values for zodiac and non-zodiac year observations separately, as well as their difference. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table 5: Relationship between chairman's zodiac year and firm R&D

	Dependent variable: R&D						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	-0.144**	-0.137**	-0.136**	-0.120**	-0.116**	-0.132**	-0.184***
	(0.0683)	(0.0571)	(0.0573)	(0.0544)	(0.0546)	(0.0625)	(0.0683)
Zodiac (1 year lag)						-0.056	
						(0.0602)	
Zodiac (1 year forward)						-0.019	
						(0.0555)	
Education			-0.024	-0.002	0.007	-0.003	0.009
			(0.0558)	(0.0556)	(0.0564)	(0.0556)	(0.0581)
Age			-0.003	0.011**		0.011**	0.014**
			(0.00501)	(0.00489)		(0.00491)	(0.00586)
Female			-0.002	0.000	-0.005	0.000	0.027
			(0.166)	(0.181)	(0.181)	(0.181)	(0.215)
log(Assets)				0.096	0.098	0.097	0.095
				(0.0696)	(0.0705)	(0.0696)	(0.0783)
Leverage				0.292	0.306	0.296	-0.011
				(0.219)	(0.221)	(0.220)	(0.0269)
PctCash				1.597***	1.598***	1.597***	1.038***
				(0.0930)	(0.0933)	(0.0930)	(0.401)
Tobins Q				0.071***	0.071***	0.071***	0.013
				(0.0197)	(0.0197)	(0.0196)	(0.00852)
Winsorized	Yes	Yes	Yes	Yes	Yes	Yes	No
Age cohort FE and spline	No	No	No	No	Yes	No	No
Firm FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	0.020	0.020	0.020	0.019	0.019	0.019	0.020
Adjusted R^2	0.000	0.622	0.622	0.667	0.668	0.667	0.501
Number of observations	9372	9184	9174	8557	8557	8557	8557

Notes: This table shows the relationship between the birth of a firm's chairman and R&D expenditure as a percentage of lagged assets. The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year controls include the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In columns (1) - (6) all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table 6: Relationship between chairman zodiac year and firm M&A activity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Dependent variable: Acquisition				
Zodiac	-4.791***	-3.931***	-3.939***	-4.160***	-3.971***	-4.313***	-3.963***
	(1.288)	(1.322)	(1.324)	(1.376)	(1.382)	(1.448)	(1.380)
Zodiac (1 year lag)						-0.992	
						(1.482)	
Zodiac (1 year forward)						0.062	
						(1.544)	
Education			1.732	1.766	1.789	1.758	1.824
			(1.388)	(1.457)	(1.474)	(1.458)	(1.481)
Age			0.117	0.197		0.198	0.181
			(0.127)	(0.129)		(0.129)	(0.131)
Female			-1.748	-2.150	-2.407	-2.150	-1.907
			(4.856)	(5.272)	(5.259)	(5.267)	(5.325)
log(Assets)				7.002***	6.703***	7.021***	5.892***
				(1.765)	(1.760)	(1.766)	(1.572)
Leverage				15.954***	15.669***	16.005***	-0.309*
				(5.495)	(5.439)	(5.496)	(0.185)
PctCash				-4.571***	-4.404***	-4.574***	-2.186**
				(1.206)	(1.215)	(1.206)	(1.007)
Tobins Q				1.865***	1.835***	1.870***	0.256**
				(0.358)	(0.358)	(0.358)	(0.108)
Winsorized	Yes	Yes	Yes	Yes	Yes	Yes	No
Age cohort FE and spline	No	No	No	No	Yes	No	No
Firm FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	0.197	0.200	0.200	0.202	0.202	0.202	0.202
Adjusted R^2	0.001	0.119	0.119	0.137	0.138	0.137	0.131
Number of observations	9373	9185	9175	8557	8557	8557	8557

Notes: This table shows the relationship between the birth of a firm's chairman and *Acquisition*, an indicator variable denoting M&A activity in a given year; we multiply the outcome variable by 100 to make the coefficients in this table more readily comparable to our R&D results. The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year controls include log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In columns (1) - (6) all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Appendix:

Table A.1: Relationship between CHFS respondent zodiac year and investment risk preferences: Alternative measure of risk aversion

	Dependent variable: InvRiskAversion						
	Full Sample				±3 years	±2 years	±1 years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	0.046	0.048*	0.053**	0.054**	0.053**	0.054*	0.041
	(0.0280)	(0.0260)	(0.0261)	(0.0256)	(0.0265)	(0.0275)	(0.0301)
Age		0.063***		0.034***	0.033***	0.033***	0.045***
		(0.00456)		(0.00543)	(0.00738)	(0.00882)	(0.0112)
Age^2		-0.000***		-0.000	-0.000	-0.000	-0.000
		(0.0000501)		(0.0000584)	(0.0000809)	(0.0000969)	(0.000123)
Female				0.271***	0.269***	0.269***	0.266***
				(0.0159)	(0.0204)	(0.0238)	(0.0301)
Employed				-0.053***	-0.018	-0.016	-0.038
				(0.0176)	(0.0226)	(0.0265)	(0.0333)
Age cohort FE and spline	No	No	Yes	No	No	No	No
Personal background FE	No	No	No	Yes	Yes	Yes	Yes
Mean of the D.V.	3.941	3.941	3.941	3.941	3.947	3.949	3.959
Adjusted R^2	0.000	0.105	0.105	0.143	0.140	0.150	0.158
Number of observations	23674	23674	23674	23672	14384	10334	6285

Notes: This table shows, using data from the China Household Finance Survey 2013, the relationship between a respondent's birth year and his response to the question, "What is your choice among combinations of risk and return?" The dependent variable, InvRiskAversion, is a respondent's answer to the preceding question, on a 5-point scale, increasing in risk aversion (see text for details). Zodiac is an indicator variable denoting that, in 2013, the respondents age was a multiple of 12. Columns (4) - (7) include, in addition to basic demographic controls, fixed effects for political status, educational attainment, religion, and marital status. The other variables definitions are self-explanatory. Columns (5) - (7) limit the sample to individuals whose in 2013 is within 3, 2, and 1 years of their zodiac year respectively. See text for details on variable definitions and construction. Robust standard errors in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table A.2: Relationship between chairman's zodiac year and firm R&D (SOE sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Dependent variable: R&D			
Zodiac	0.075	0.024	0.025	0.028	0.044		-0.108**
	(0.0547)	(0.0381)	(0.0381)	(0.0386)	(0.0383)		(0.0543)
Zodiac (1 year lag)						0.013	
						(0.0356)	
Zodiac (1 year forward)						-0.048	
						(0.0398)	
Zodiac × SOE							0.127*
							(0.0665)
SOE							-0.021
							(0.0903)
Education			-0.016	-0.009	-0.010	-0.008	-0.013
			(0.0373)	(0.0381)	(0.0379)	(0.0379)	(0.0323)
Age			0.006	0.005		0.005	0.006*
			(0.00413)	(0.00416)		(0.00416)	(0.00328)
Female			-0.092	-0.105	-0.099	-0.104	-0.092
			(0.128)	(0.130)	(0.133)	(0.130)	(0.111)
log(Assets)				0.121**	0.121**	0.121**	0.113***
				(0.0548)	(0.0547)	(0.0548)	(0.0439)
Leverage				-0.327	-0.316	-0.324	-0.065
				(0.202)	(0.202)	(0.202)	(0.149)
PctCash				0.641***	0.642***	0.641***	1.386***
				(0.139)	(0.139)	(0.139)	(0.0777)
Tobins Q				0.036*	0.036*	0.036*	0.048***
				(0.0188)	(0.0188)	(0.0187)	(0.0138)
Winsorized	Yes	Yes	Yes	Yes	Yes	Yes	No
Age cohort FE and spline	No	No	No	No	Yes	No	No
Firm FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	0.008	0.008	0.008	0.008	0.008	0.008	0.013
Adjusted R^2	0.000	0.635	0.635	0.643	0.643	0.643	0.681
Number of observations	9489	9416	9413	9113	9113	9113	17755

Notes: This table shows the relationship between the birth of a firm's chairman and R&D expenditure as a percentage of lagged assets. The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year characteristics include R&D, the percentage of research and development expenditures to lagged assets; Acquisition, an indicator variable denoting M&A activity; log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In columns (1) - (6) all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table A.3: Relationship between chairman zodiac year and firm M&A activity (SOE sample)

| | *Dependent variable:* Acquisition | | | | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Zodiac	-0.566	0.093	0.073	-0.162	-0.115		-4.533***
	(1.254)	(1.268)	(1.270)	(1.295)	(1.301)		(1.363)
Zodiac (1 year lag)						0.217	
						(1.268)	
Zodiac (1 year forward)						1.737	
						(1.460)	
Zodiac × SOE							4.367**
							(1.878)
SOE							0.013
							(2.325)
Education			-1.244	-1.421	-1.508	-1.438	-0.113
			(0.929)	(0.965)	(0.964)	(0.964)	(0.788)
Age			-0.083	-0.125		-0.124	0.067
			(0.101)	(0.103)		(0.103)	(0.0800)
Female			0.251	1.326	1.969	1.301	-0.024
			(3.043)	(3.048)	(2.958)	(3.054)	(2.696)
log(Assets)				0.246	0.299	0.254	4.817***
				(1.531)	(1.532)	(1.531)	(1.019)
Leverage				0.733	0.679	0.631	8.770***
				(4.727)	(4.735)	(4.725)	(3.356)
PctCash				-0.152	-0.365	-0.166	-5.761***
				(2.599)	(2.605)	(2.604)	(1.042)
Tobins Q				0.832**	0.872**	0.818*	1.865***
				(0.416)	(0.417)	(0.418)	(0.255)
Winsorized	Yes	Yes	Yes	Yes	Yes	Yes	No
Age cohort FE and spline	No	No	No	No	Yes	No	No
Firm FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	0.146	0.146	0.146	0.145	0.145	0.145	0.173
Adjusted R^2	-0.000	0.098	0.098	0.099	0.100	0.099	0.120
Number of observations	9490	9417	9414	9113	9113	9113	17755

 Notes: This table shows the relationship between the birth of a firm's chairman and M&A expenditure as a percentage of lagged assets. The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year characteristics include R&D, the percentage of research and development expenditures to lagged assets; Acquisition, an indicator variable denoting M&A activity; log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In columns (1) - (5) all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table A.4: Relationship between chairman's zodiac year and corporate investment: chairman FEs and CEO zodiac year specifications

| | Dependent variables: | | | |
| | Aquisition | | R&D | |
	(1)	(2)	(3)	(4)
Zodiac	-4.504***	-4.534***	-0.153**	-0.131**
	(1.566)	(1.485)	(0.0652)	(0.0593)
Zodiac (CEO)		1.237		-0.014
		(1.655)		(0.0623)
Education		1.854		-0.036
		(1.455)		(0.0548)
Age		0.223*		0.001
		(0.128)		(0.00500)
Female		-2.321		0.043
		(5.316)		(0.194)
log(Assets)	7.815***	6.382***	0.370***	0.321***
	(2.246)	(1.747)	(0.0894)	(0.0687)
Leverage	23.069***	19.950***	-1.124***	-1.158***
	(6.704)	(5.296)	(0.264)	(0.211)
Tobins Q	2.064***	1.838***	0.074***	0.080***
	(0.457)	(0.358)	(0.0232)	(0.0206)
Winsorized	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Chairman FE	Yes	No	Yes	No
Mean of the D.V.	0.199	0.202	0.020	0.019
Adjusted R^2	-0.082	0.136	0.540	0.624
Number of observations	8297	8566	8296	8565

Notes: This table shows the relationship between the birth of a firm's chairman and *Acquisition*, an indicator variable denoting M&A activity in a given year (columns 1 and 2); and R&D expenditure as a percentage of lagged assets (columns 3 and 4). The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year controls include log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In all columns, all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table A.5: Relationship between chairman's zodiac year and firm characteristics

	Tobins Q		Leverage		
	Current	1-year forward	All	Short-term	Long-term
	(1)	(2)	(3)	(4)	(5)
Zodiac	5.076	-3.710	0.367	-0.279	0.136
	(5.031)	(4.720)	(0.369)	(0.309)	(0.198)
Education	-0.476	0.935	-0.218	-0.021	-0.062
	(7.117)	(6.472)	(0.603)	(0.429)	(0.250)
Age	-1.279*	0.635	-0.034	0.038	-0.032
	(0.698)	(0.742)	(0.0591)	(0.0412)	(0.0276)
Female	22.327	50.898	1.252	0.673	-1.009
	(30.88)	(32.96)	(1.758)	(1.320)	(0.822)
log(Assets)	-141.236***	-114.835***	5.142***	3.868***	4.286***
	(9.336)	(8.707)	(0.965)	(0.602)	(0.404)
PctCash	15.473**	7.036	-10.509***	-1.228***	-0.100
	(6.813)	(5.976)	(0.549)	(0.430)	(0.228)
Winsorized	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	2.777	2.667	0.393	0.131	0.039
Adjusted R^2	0.692	0.680	0.785	0.610	0.524
Number of observations	8557	7309	9166	9166	9137

Dependent variables:

Notes: This table shows the relationship between the birth of a firm's chairman and two main firm characteristics: Tobin's Q (the ratio of the market value of equity and book value of debt to total assets) and Leverage (the firm's debt-to-asset ratio). The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year controls include log(Assets), the logarithm of the firm's total asset and PctCash, the percentage of the firm's assets held as cash. In all columns, all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.

Table A.6: Relationship between chairman's zodiac year and corporate investment: heterogeneous effects

| | *Dependent variables:* | | | | | | | |
| | R&D | | | | Acquisition | | | |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Zodiac	-0.064	-0.125**	-0.127*	-0.124	-0.881	-4.272***	-5.502***	-7.483***
	(0.100)	(0.0551)	(0.0671)	(0.0961)	(2.569)	(1.399)	(1.651)	(2.361)
College Education	-0.046				3.464			
	(0.116)				(3.176)			
Zodiac × College	-0.078				-4.566			
	(0.119)				(3.035)			
Overseas Education		0.221				13.191		
		(0.431)				(8.767)		
Zodiac × Overseas		0.295				0.717		
		(0.328)				(7.217)		
(CEO==Chairman)			-0.035				1.051	
			(0.0738)				(1.678)	
Zodiac × (CEO==Chairman)			0.021				3.963	
			(0.117)				(2.958)	
$\sum Ownership^2$ of top 5 shareholders				0.088				-40.820***
				(0.511)				(12.31)
Zodiac × $\sum Ownership^2$				0.030				21.194*
				(0.486)				(12.80)
Education			-0.002	-0.002			1.745	1.619
			(0.0555)	(0.0556)			(1.455)	(1.434)
Age	0.010**	0.012**	0.010**	0.011**	0.184	0.175	0.209	0.177
	(0.00481)	(0.00505)	(0.00495)	(0.00490)	(0.128)	(0.123)	(0.130)	(0.128)
Female	0.004	0.025	-0.002	-0.001	-2.383	-3.224	-2.067	-1.572
	(0.181)	(0.203)	(0.182)	(0.181)	(5.242)	(5.606)	(5.260)	(5.251)
log(Assets)	0.096	0.066	0.096	0.094	7.056***	6.929***	7.025***	7.923***
	(0.0696)	(0.0679)	(0.0696)	(0.0711)	(1.767)	(1.787)	(1.764)	(1.689)
PctCash	1.597***	1.592***	1.599***	1.597***	-4.632***	-4.784***	-4.665***	-4.465***
	(0.0930)	(0.0928)	(0.0932)	(0.0929)	(1.205)	(1.215)	(1.211)	(1.194)
Leverage	0.294	0.326	0.292	0.294	16.091***	16.344***	15.817***	15.208***
	(0.219)	(0.223)	(0.219)	(0.219)	(5.494)	(5.543)	(5.510)	(5.415)
Tobins Q	0.071***	0.067***	0.071***	0.071***	1.869***	1.927***	1.861***	1.942***
	(0.0197)	(0.0195)	(0.0197)	(0.0196)	(0.358)	(0.367)	(0.359)	(0.356)
Winsorized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean of the D.V.	0.019	0.019	0.019	0.019	0.202	0.201	0.202	0.202
Adjusted R^2	0.667	0.672	0.667	0.667	0.137	0.136	0.137	0.139
Number of observations	8557	8507	8557	8557	8557	8507	8557	8557

Notes: This table shows the relationship between the birth of a firm's chairman and *Acquisition*, an indicator variable denoting M&A activity in a given year (columns 1 – 4); and R&D expenditure as a percentage of lagged assets (columns 5 – 8). The sample of firms includes all non-SOE firms traded on the Shanghai and Shenzhen exchanges during 2007–2015. Zodiac is an indicator variable denoting the chairman's zodiac year; all other chairman characteristics are self-explanatory (see text for details). Firm-year covariates include log(Assets), the logarithm of the firm's total asset; Leverage, the firm's debt-to-asset ratio; PctCash, the percentage of the firm's assets held as cash, and TobinsQ, the ratio of the market value of equity and book value of debt to total assets. In all columns, all continuous variables are winsorized at the 1 percent level. All coefficients have been scaled up by a factor of 100. Robust standard errors, clustered at the firm level, are in parentheses. ***, **, * denote statistical significance at the 1%, 5% and 10% levels.