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Marriage and Managers' Attitudes to Risk

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Marital status can both reflect and affect individual preferences. We explore the impact of marriage on corporate chief executive officers (CEOs) and find that firms run by single CEOs exhibit higher stock return volatility, pursue more aggressive investment policies, and do not respond to changes in idiosyncratic risk. These effects are weaker for older CEOs. Our findings continue to hold when we use variation in divorce laws across states to instrument for CEO marital status, which supports the hypothesis that marriage itself drives choices rather than it just reflecting innate heterogeneity in preferences. We explore various potential explanations for why single CEOs may be less risk averse.

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Do managers' personal traits matter? A burgeoning recent literature provides ample evidence that individual chief executive officer (CEO) characteristics impact corporate policies. One of the key dimensions of heterogeneity across individuals is differential attitudes toward risk. Such heterogeneity can have important real consequences insofar as it drives corporate investment and research and development (R&D) activities. In this paper, we explore whether risk attitudes across CEOs reflect only innate differences in preferences or whether factors external to the firm also play a role. More specifically, we investigate the impact of CEO marital status on corporate risk taking.

We explore this question using a standard sample of U.S. public firms, which we augment with a new data set on marital status of CEOs that we compile from a variety of public sources. We find that companies run by CEOs classified as single in our data set exhibit higher levels of stock return volatility and pursue more aggressive investment policies than otherwise comparable firms, consistent with the hypothesis of greater risk taking by single managers. These effects are both economically and statistically quite meaningful. A firm headed by a single CEO, controlling for a variety of personal and firm characteristics, exhibits stock return volatility that is 3% higher and invests 10% more on average.

The difference in volatilities is driven by varying exposures to idiosyncratic rather than systematic risk. The investment policies vary with marital status for capital expenditures, as well as R&D spending and acquisitions, which are commonly associated with risk taking. There is also some evidence that firm leverage is higher for firms with single CEOs. The effect of marital status is weaker for older managers, indicating that selection into marriage based on an unobserved personal characteristic that is correlated with risk taking is an unlikely driver of our results. This is because such a selection effect would suggest the opposite pattern: if the propensity to get married varies across people, those for whom this propensity is low will likely be overrepresented among single individuals at older ages.

Importantly, we control for firm characteristics in our analysis, so that our findings do not simply reflect the tendency of single CEOs to be matched with riskier firms. If we omit firm controls, the relationship between marital status and risk taking becomes significantly stronger (coefficients typically increase by a factor of five), suggesting that single CEOs indeed are more likely to run relatively risky firms.[1] Furthermore, we demonstrate that single CEOs impact firm investment decisions by exploiting within-firm variation in idiosyncratic return volatility over time. We show that whereas married CEOs reduce investment in response to an increase in idiosyncratic risk (consistent with Panousi and Papanikolaou 2012), those CEOs who are single

[1] The only exception is firm leverage, where the relation disappears with no firm controls, probably because the highest-risk firms typically have no or very little debt.

do not, confirming that they are less averse to (idiosyncratic) risk. The latter result is based on within-firm variation in idiosyncratic volatility, and therefore it cannot be attributed to unobserved firm heterogeneity driving differences in investment rates across firms.

These results support the hypothesis that single CEOs assume more risk than married ones. However, it is also possible that single managers exhibit different risk-taking behavior from married managers due to unobserved differences between managers. Individuals who are single at a given age may be inherently more risk tolerant than those who are married by the same age. To distinguish our explanation from the alternative of innate heterogeneity, we employ an instrumental variables (IV) approach.

Our instrument exploits variation in divorce laws across different states in the United States, which is very plausibly exogenous to the CEO–firm match and to firms' investment policies. Our basic assumption is that divorce costs should influence an individual's propensity to get married. One aspect of these costs, which should be of particular concern for wealthy individuals, is the division of marital property. We therefore distinguish between states where this division is determined by the *community property* standard and those where it is determined by the *equitable distribution* standard. The former mandates equal division of assets acquired during marriage between the two divorcing spouses, whereas the latter allows the division to be determined by a judge based on a range of factors, including the relative contributions of the spouses to household wealth. It is commonly understood that community property is more advantageous for the poorer spouse (Voena 2011). Since a CEO should rarely be in this position, he or she should find divorce costlier in community property states. Consequently, all else equal, a CEO working in such a state should be less likely to be married at a given point in time. Indeed, this hypothesis is strongly confirmed by the data.[2] Our evidence indicates that the observed effect of community property regime on marital status is unlikely to just reflect other differences across states, such as income distribution, culture, or religion. Crucially, when we use the state divorce law as an instrument for marital status, all our findings continue to hold (and are actually stronger), suggesting the relation between marital status and risk taking is not simply driven by innate differences between CEOs who single or married.

One of the important questions in the literature that studies the impact of managerial characteristics on firm outcomes is whether managers can alter their firms' policies to better suit their personal objectives or whether the observed differences in the behavior of firms run by different managers simply reflect the matching of executives and firms along the relevant (but difficult to observe for an econometrician) characteristics (e.g., more risk-tolerant CEOs work for riskier firms). Although we cannot completely rule out the latter mechanism as an explanation for some of our results, we find it reasonably unlikely, as marital status is not a permanent characteristic of a CEO. Moreover, even if CEOs were always optimally matched to firms, so that their preferences are fully in line with shareholder interests, our findings would still show that riskier firms prefer single CEOs, who are more willing to engage in risky projects.

In this paper, we show that marital status impacts CEO behavior, more specifically attitude toward risk. Why should marital status affect risk-taking behavior of CEOs? There exist a number of mechanisms through which marriage can alter individual risk attitudes. Having a family may raise the level of commitment consumption (or habit), which increases induced risk aversion. A married manager may also have a higher opportunity cost of effort, which is likely complementary to risk taking, since leisure time may be more valuable for someone who has a spouse and children. If a typical CEO is more risk tolerant than an average person in the population and, in particular, than his or her spouse, aggregation of preferences often implies that the combined objective function of the family exhibits greater aversion to risk compared with that of a single manager. To the extent that the CEO maximizes welfare of the whole family, these aggregated preferences drive choices that the manager makes. Thus, even if a CEO's own personal preferences are unchanged by marriage, married managers should exhibit more conservative decision making with respect to firm policies than single ones, all else equal (although the implications of aggregation of risk preferences within a family are not always straightforward, as explored in Mazzocco 2004).

Rather than indirectly influencing CEO behavior, marital status may have a direct biological effect on preferences, for example, by leading to lower testosterone levels in married males (e.g., Burnham et al. 2003), which are known to be correlated with risk taking (e.g., Burnham 2007, Guiso and Rustichini 2011, Sapienza et al. 2009). Alternatively, rather than marriage increasing risk aversion, it could be the case that being single reduces risk aversion as a result of similar evolutionary mechanisms (e.g., Baker and Maner 2008). Finally, single individuals may care more about their relative position in the wealth distribution because of competition for mates in the marriage market (Becker 1973). As long as the improvement in the potential quality of the marital match raises the benefit of an extra dollar of wealth (beyond its pure consumption value), the matching environment creates an incentive

[2] A similar pattern holds in the broader U.S. population, but only for wealthier individuals—exactly as our hypothesis about costlier marriage in community property states implies.

for individuals to take more (idiosyncratic) risk than they would in the absence of the status contest (e.g., see Cole et al. 2001, Roussanov 2010).

1. Data

1.1. CEO Characteristics

We collect the names, biographical information, and compensation of all CEOs covered by ExecuComp in the 1993–2008 period. We then research their marital and family status using a variety of public sources, such as the *Marquis Who's Who in Finance and Industry*, the Notable Names Database, the U.S. Securities and Exchange Commission's insider filings, and various media mentions. The ultimate goal of this effort is to establish whether a particular CEO was married or single during his or her tenure. Unfortunately, we can obtain the actual marriage dates only for a small minority of CEOs, which means that for the bulk of our sample we have to rely on an indirect approach. More specifically, for those CEOs for whom we can find no dates, we start with the assumption that they are single and then change their status if we find information indicating the opposite.[3] Any CEO who is ever mentioned as being married but the exact dates of marriage are not available is coded as married throughout his or her tenure. This means that some CEOs who are divorced or whose spouses are deceased may be wrongly counted as married. However, there also exists an offsetting bias. Since we require evidence to classify a CEO as married, those CEOs who are not prominent enough to warrant mention in our sources (or those who are very private with regard to their personal information) will appear in the data as single even if they are actually married. Although we perform a comprehensive search for all CEOs, it is inevitable that we miss some. Furthermore, some CEOs may be involved in marriage-like relationships but not be formally married, and their status for our purposes should be classified as married but will not be.

The net effect of these biases cannot be determined with much certainty, but we are hopeful our data are not too unrepresentative. Table 1 shows that in terms of CEO–year observations, married CEOs account for 84% of our sample. If we just consider each individual CEO, single ones make up 20% of our sample.[4] According to U.S. census data, 70% of men in the 35–59 age range were married in 2000. This group represents most of the CEOs in our sample, so it would appear that we overestimate the number of currently married CEOs.[5] But CEOs are also much wealthier than typical Americans, and wealth is positively correlated with the probability of being married. We use the 2001 Survey of Consumer Finances data to show that the proportion of single CEOs in our sample is quite close to what we would expect to find in the general population, based on the median CEO age, wealth, and income (these and other unreported results are available on our websites[6]).

If we wrongly characterized marital status of some CEOs, this would not constitute a problem for our analysis, as long as this effect was uncorrelated with anything else. The problem is that this may not be true for CEOs who are married, with no public information documenting their status. Such CEOs are likely to be less prominent than their peers and could potentially be associated with younger, riskier firms. This effect may explain risk-taking attitudes of managers we classify as "single," without any actual effect of marital status. For example, Malmendier and Tate (2009) find that "superstar" CEOs exhibit different behaviors than their less prominent counterparts.[7] This may represent a serious problem for our analysis, which we address in several ways.

First, in our regressions we use as controls observable measures that are likely to be correlated with both the degree of prominence of a company and its riskiness, such as firm size, market-to-book ratio, and age. Second, we explicitly control for the effect of prominence on our classification of CEOs as married or single by constructing measures of the frequency of CEO and company media mentions. Specifically, we use the Factiva Dow Jones database to count the number of news stories mentioning the CEO and/or the company associated with each of the observations during our sample period. We use these measures to control for the effect of prominence on risk taking in our analysis. Although these controls do appear to capture some variation in firm risk, their inclusion does not affect our results in any way.

[3] Our information sources report that a CEO is married reasonably frequently but almost never directly report that one is single, so we cannot start with the assumption that a CEO is married unless we find evidence to the contrary.

[4] Although there are a number of CEOs who are divorced in our sample, we do not explicitly consider divorced CEOs to be "single" because it is not obvious from the perspective of the various theories we consider that we should, especially given that the effective timing of divorce is very difficult to ascertain.

[5] At the same time, we may be underestimating the proportion of CEOs who were married at any point in time (though not necessarily during their tenure). In the census data, of the men falling in the 1950–1954 birth cohort, 89% had been married at some point before reaching the age of 50.

[6] http://finance.wharton.upenn.edu/~nroussan/; http://sites.temple.edu/psavor/.

[7] Such "superstar status" could itself be viewed as a type of status payoff that induces risk taking. Shemesh (2010) presents evidence that achieving this status leads CEOs to reduce subsequent risk taking.

Table 1 Summary Statistics

	Investment	*CapEx*	*R&D*	*Advertising*	*NetAcqusitions*	*Volatility*	*IdVol*
Panel A: Risk-taking measures							
Married CEOs							
Mean	0.90	0.27	0.25	0.08	0.24	0.37	0.34
Median	0.36	0.19	0.00	0.00	0.00	0.31	0.28
1st %	−0.02	0.01	0.00	0.00	−0.31	0.00	0.09
99th %	11.25	1.69	4.50	1.63	6.31	3.72	1.12
N	21,876	21,876	21,876	21,876	21,876	20,433	20,418
Single CEOs							
Mean	1.52	0.32	0.58	0.12	0.38	0.45	0.42
Median	0.48	0.22	0.00	0.00	0.00	0.37	0.34
1st %	0.00	0.00	0.00	0.00	−0.29	0.07	0.11
99th %	19.85	2.04	8.86	3.94	9.51	9.51	1.41
N	4,224	4,224	4,224	4,224	4,224	3,786	3,785

	Assets	*M/B*	*CF*	*Leverage*	*FirmAge*	*Age*	*Tenure*	*Wealth*
Panel B: Control variables								
Married CEOs								
Mean	12,517	1.94	0.54	0.36	25.6	55.0	5.1	166
Median	1,615	1.46	0.39	0.35	22.0	55.0	4.0	16
1st %	47	0.79	−5.30	0.00	3.0	38.0	0.0	0
99th %	208,335	8.85	8.38	1.27	57.0	77.0	24.0	1,853
N	21,856	21,876	21,876	21,876	21,876	20,885	21,876	16,531
Single CEOs								
Mean	2,076	2.14	0.31	0.30	18.5	52.6	4.5	36
Median	595	1.56	0.37	0.25	13.0	53.0	3.0	8
1st %	26	0.69	−12.20	0.00	3.0	36.0	0.0	0
99th %	24,563	10.82	17.42	1.57	57.0	70.0	22	360
N	4,220	4,224	4,224	4,224	4,224	3,960	4,224	2,969

Notes. Panel A reports the summary statistics for various measures of firm risk taking. *Investment* and its components (*CapEx*, *R&D*, *Advertising*, and *NetAcqusitions*) are relative to *PP&E*. *Volatility* is the (annualized) standard deviation of monthly stock returns over the previous year. Idiosyncratic volatility (*IdVol*) is the standard deviation of residuals from the regression of stock returns on the market return. Panel B reports the summary statistics for our main control variables. Firm assets (*Assets*) and CEO wealth (*Wealth*) are expressed in millions. Market-to-book ratio (*M/B*) is the ratio of the market value of assets to their book value. Cash flow (*CF*) equals earnings before extraordinary items plus depreciation and amortization, scaled by net *PP&E*. Book leverage (*Leverage*) equals the sum of long-term and current debt divided by the sum of long-term debt, current debt, and book equity. *FirmAge* is computed with respect to the first year it appears in Compustat (expressed in years, as are *Age* and *Tenure*).

1.2. Other Control Variables

We augment our CEO data set with information from Compustat and the Center for Research in Security Prices (CRSP), which we use to construct measures of corporate risk taking and the necessary control variables. The various variables we use are defined below (all numbers except ratios are in millions).[8]

Total investment (*Investment*) is capital expenditures (*CapEx*) plus acquisitions minus asset sales (*NetAcquisitions*) plus R&D expenditure (*R&D*) plus advertising expenditure (*Advertising*), scaled by net property, plant and equipment (*PP&E*). This is a more comprehensive measure than used in most of the literature, but we believe R&D and advertising expenditures should be counted as investment for our purposes because they do reflect a firm's risk taking (Guay 1999 uses R&D expenditure as a proxy for CEO risk taking; see also Coles et al. 2006). We also consider the individual components of investment separately (scaled by *PP&E*). Total volatility is computed as the annualized volatility of a firm's monthly stock returns over the previous year. Idiosyncratic volatility is calculated as the annual volatility of the residuals of the firm's stock returns regressed on the CRSP value-weighted stock market portfolio return.

Firm size ($\log A$) is the log of its total assets. Book equity (*BE*) equals stockholders' equity; if that item is missing in Compustat, then it is common equity plus preferred equity, and if those items are unavailable as well, then it is total assets minus total liabilities. Market-to-book ratio (*M/B*) is the ratio of the market value of assets relative to their book value, where the market value of assets is the total value of assets minus book value of equity plus market value of equity. Cash flow (*CF*) equals earnings before extraordinary

[8] We include in our sample all firms for which we have the necessary data. Our results continue to hold if we exclude financial firms.

items plus depreciation and amortization, scaled by net *PP&E*. Book leverage (*Leverage*) equals the sum of long-term and current debt divided by the sum of long-term debt, current debt, and book equity. *FirmAge* is computed with respect to the first year it appears in Compustat. All firm-related variables (except size and book equity) are Winsorized at the 1% and 99% levels.

We also use information available in ExecuComp on the relevant characteristics of managers. CEO wealth (*Wealth*) is the log of CEO's total holdings of own company stock and options, which we use as a proxy for total CEO wealth. *Age* and *Tenure* are the CEO's age and his tenure with the firm, as of the current year. The Factiva-based measures of CEO and firm prominence are each defined as the logarithm of the total number of their media mentions during our sample period. For CEOs, we only count news stories that are explicitly related to the firm they run to avoid greatly exaggerating the prominence of CEOs with common names. *Inst* is a fraction of firm's equity held by institutional investors.

2. CEO Marital Status and Risk Taking

2.1. Overview

Table 1 presents the main summary statistics for our data, grouping firms based on the marital status of their CEOs. It confirms that our classification produces intuitive results: married CEOs are on average somewhat older and, consistent with the theory that relates marital market success with wealth, richer (insofar as we can proxy CEO wealth with the value of their holdings of the company's stock and options). This first look at the data also supports our main hypothesis that marital status matters: firms managed by CEOs whom we classify as single display markedly different characteristics. Such firms have higher investment and experience greater return volatility, both of which should be related to the amount of risk associated with a firm. The differences are highly significant, both economically and statistically. Return volatility of single CEO firms is 24% higher, and a t-test for the difference produces a t-statistic of about 14 (untabulated). Investment is 69% higher for such firms relative to those run by married CEOs, with a t-statistic of 13 for the difference.

These differences appear to be quite dramatic, but single CEO-run firms are also on average smaller, younger, and potentially faster growing, as indicated by their higher market-to-book ratios. Since both small and growth firms tend to invest more and have more volatile returns, it is important to control for these characteristics. We therefore run a variety of regression specifications with investment and return volatility as dependent variables:

$$RiskTaking = \alpha + \beta \times Single + \gamma \times X + \delta \times Y + \zeta \times (Single \times \tilde{Y}), \quad (1)$$

where *RiskTaking* is our measure of risk taking, *Single* is a dummy variable equal to 1 if the CEO is unmarried and 0 otherwise, X is a set of firm characteristics, Y is a set of CEO characteristics (the specific variable definitions are given above), and $\tilde{Y}$ are the same characteristics that have been demeaned.[9] All our regressions also include year × industry (based on the Fama and French (1997) 49-industry classification) fixed effects, or just year fixed effects in the specification where we omit firm-specific controls. We compute t-statistics using standard errors clustered by firm.

2.2. Single CEOs Run Riskier Firms: Examining Return Volatility

Table 2 presents regression results for the total (annualized) volatility of firm stock returns and for the idiosyncratic component of volatility. The coefficient of most interest is the dummy variable *Single*.

Do firms led by single CEOs experience greater return volatility, controlling for firm characteristics? Results reported in Table 2 show that firms run by single CEOs do indeed exhibit more volatile returns. This difference is statistically significant (t-stat. = 2.32 in column 1, which features the most comprehensive sets of control variables) and economically meaningful, with the coefficient magnitude suggesting about a 3% difference.[10] The coefficient is exactly the same for idiosyncratic volatility (column 3), suggesting that it is the main channel through which managers' marital status affects firm risk taking (i.e., single CEO firms assume more firm-specific risk rather than economy-wide systematic risk).

Importantly, all firm-level control variables have the expected effect in our regressions: firms with low cash flows, firms with high market-to-book ratios, small firms, firms with high leverage, and young firms have more volatile stock returns. Since married and single CEOs also have different personal characteristics, we also include controls for CEO characteristics, such as age and tenure, and the interactions between those characteristics and the single status dummy variable (characteristics variables in the interaction terms are always demeaned). Older CEOs may behave more conservatively.[11] Since they are also more likely to be married, not controlling for CEO age could lead to a positive coefficient on *Single*, even if marital status had no impact on CEO preferences. Consistent with prior

[9] Coles et al. (2006) show that CEO compensation has a meaningful effect on firm risk taking through the pay–performance sensitivity; controlling for CEO compensation and holdings of company stock does not affect our main results.

[10] This is computed as 0.012 (*Single* coefficient magnitude) divided by 0.370 (mean return volatility for firms run by married CEOs).

[11] Levi et al. (2010) document more aggressive deal-making behavior among younger CEOs and argue that it is driven by their higher testosterone levels.

Table 2 Regression Results for Stock Return Volatility

	Total		Idiosyncratic	
	1	2	3	4
Single	0.012	0.067	0.012	0.063
	(2.320)	(7.827)	(2.520)	(8.085)
CF_t	−0.006		−0.004	
	(−6.810)		(−4.200)	
M_{t-1}/B_{t-1}	0.000		−0.002	
	(0.210)		(−1.680)	
$\text{Log}A_{t-1}$	−0.022		−0.027	
	(−9.120)		(−11.850)	
$Leverage_t$	0.097		0.085	
	(10.130)		(9.690)	
Vol_{t-1}	0.335		0.327	
	(7.930)		(7.260)	
FirmAge	−0.001		−0.001	
	(−7.320)		(−7.200)	
Age	−0.001	−0.004	−0.001	−0.004
	(−3.470)	(−11.458)	(−3.710)	(−11.370)
Age × *Single*	−0.001	−0.002	−0.001	−0.001
	(−1.520)	(−1.188)	(−1.310)	(−0.960)
Tenure	−0.001	−0.001	−0.001	−0.000
	(−2.340)	(−1.021)	(−2.070)	(−0.819)
Tenure × *Single*	−0.000	0.000	0.000	−0.001
	(1.800)	(−0.198)	(0.230)	(−0.464)
CEOProminence	0.003	−0.007	0.003	−0.008
	(2.750)	(−4.556)	(2.890)	(−6.177)
FirmProminence	−0.001		−0.001	
	(−1.190)		(−0.640)	
Inst	−0.045		−0.050	
	(−4.710)		(−5.590)	
Inst × *Single*	−0.054		−0.064	
	(−1.610)		(−1.930)	
Industry × year fixed effects	Yes	No	Yes	No
Year fixed effects	No	Yes	No	Yes
N	23,028	23,094	23,011	23,278
R^2	0.512	0.196	0.482	0.189

Notes. The table reports coefficient estimates of the following OLS regression:

$$Vol = \alpha + \beta \times Single + \gamma \times X + \delta \times Y + \zeta \times (Single \times \tilde{Y}),$$

where *Vol* is either the annualized standard deviation of monthly stock returns over the previous year (total volatility) or the standard deviation of the residual from a regression of stock returns on the CRSP value-weighted market portfolio return (idiosyncratic volatility). *Single* is a dummy variable equal to 1 if the CEO is unmarried and 0 otherwise, X is a set of firm characteristics, and Y is a set of CEO characteristics (the specific variable definitions are given in §2), demeaned when used in interaction terms: $\tilde{Y} = Y - \hat{E}Y$. Industry × year fixed effects are based on the Fama–French 49-industry classification. The *t*-statistics are in parentheses and are computed using robust standard errors clustered by firm.

work, we find that age is negatively related to firm risk (as is tenure). Both age and tenure are significantly negatively related to firm risk.

The coefficient on CEO prominence is positive and significant, indicating that firms run by better-known CEOs take on more risk. However, this result depends crucially on the presence of firm-level controls. When we exclude those, the coefficient actually has the opposite sign, since firms whose CEOs tend to be most prominent are typically large and therefore less risky, especially in terms of idiosyncratic risk.

We also control for institutional holdings of company stock, obtained from Thomson Reuters database of 13F filings. We use institutional holdings as a proxy for the quality of a firm's corporate governance, under the assumption that firms with higher institutional ownership will be more responsive to shareholders. We introduce this variable to test whether greater shareholder control attenuates the effect of marital status, perhaps by making it harder for single CEOs to undertake overly risky investments. We find that firms with greater institutional ownership are indeed less risky (the coefficient is negative and statistically significant). Moreover, the interaction with the *Single* variable is negative and statistically significant, indicating that better governed firms may moderate the tendency of single managers to increase risk. This effect is particularly strong for idiosyncratic volatility.

Controlling for firm characteristics helps isolate the potential effect of manager's preferences on firm performance, but it understates the explanatory power of marital status with respect to the managers' individual behavior. In particular, insofar as potential managers choose to work for firms that match their risk preferences, single managers are likely to choose to work for companies exhibiting greater exposure to risk than married managers. The data strongly confirm this hypothesis: when we exclude controls for firm characteristics, including only CEO characteristics and time fixed effects (columns 2 and 4), the results become much stronger, with return volatility of firms run by single CEOs being 16% higher and the *t*-statistic for the difference being 7.83. This result is consistent with any theory predicting lower risk aversion for single individuals, as single CEOs are more likely to be matched with riskier firms if they are indeed less risk averse. But they also undertake more risks even when we control for this tendency, as results in columns 1 and 3 show.

2.3. Where Does Risk Come From? Evidence on Firm Investment

What drives differences in riskiness between firms run by single and married CEOs? Our hypothesis implies that besides opting to work for inherently riskier firms, single CEOs may steer their companies toward riskier projects, as well as generally pursue more aggressive investment policies. To test this prediction, we examine the effect of marital status on investment. Table 3 presents regression results for total investment and its components that are likely to have particularly pronounced effects on firm risk, net acquisitions, and R&D plus advertising expenditure.

Table 3 Regression Results for Investment

	Total investment		Net acquisitions		R&D + Advertising	
	1	2	3	4	5	6
Single	0.105	0.453	0.048	0.095	0.032	0.324
	(2.650)	(5.234)	(1.900)	(2.587)	(2.590)	(5.667)
CF_t	0.094		0.071		0.008	
	(5.710)		(10.130)		(1.410)	
M_{t-1}/B_{t-1}	0.109		0.016		0.012	
	(7.340)		(2.280)		(2.240)	
$\text{Log}A_{t-1}$	−0.145		−0.049		−0.030	
	(−11.170)		(−7.820)		(−6.540)	
$Leverage_t$	0.205		0.266		−0.029	
	(3.660)		(7.760)		(−1.690)	
$Investment_{t-1}$	0.477		0.230		0.801	
	(18.940)		(13.130)		(39.110)	
FirmAge	−0.002		−0.001		−0.000	
	(−2.720)		(−2.790)		(−0.310)	
Age	−0.004	−0.029	−0.001	−0.005	−0.001	−0.016
	(−2.700)	(−9.768)	(−0.920)	(−3.741)	(−2.100)	(−8.702)
Age × *Single*	−0.017	−0.042	−0.006	−0.012	−0.004	−0.024
	(−2.440)	(−2.928)	(−1.600)	(−2.276)	(−1.630)	(−2.478)
Tenure	−0.007	−0.007	−0.003	−0.003	−0.001	−0.003
	(−3.410)	(−1.262)	(−1.640)	(−1.257)	(−2.070)	(−1.143)
Tenure × *Single*	0.015	0.039	0.013	0.021	0.001	0.013
	(1.320)	(1.474)	(1.610)	(1.844)	(0.240)	(0.713)
CEOProminence	0.032	−0.002	0.006	−0.014	0.009	0.016
	(3.550)	(−0.186)	(1.230)	(−2.587)	(3.040)	(2.148)
FirmProminence	0.004		−0.002		0.001	
	(0.350)		(−0.320)		(0.190)	
Inst	0.121		0.167		−0.003	
	(1.680)		(4.520)		(−0.130)	
Inst × *Single*	0.019		−0.080		0.031	
	(0.090)		(−0.720)		(0.380)	
Industry × year fixed effects	Yes	No	Yes	No	Yes	No
Year fixed effects	No	Yes	No	Yes	No	Yes
N	24,815	24,835	24,815	24,835	24,815	24,835
R^2	0.463	0.043	0.179	0.014	0.770	0.048

Notes. The table reports coefficient estimates of the following OLS regression:

$$Investment = \alpha + \beta \times Single + \gamma \times X + \delta \times Y + \zeta \times (Single \times \tilde{Y}),$$

where *Investment* is defined as capital expenditures plus net acquisitions (acquisitions minus asset sales) plus R&D expenditure plus advertising expenditure scaled by net property, plant, and equipment (total investment; columns 1 and 2); net acquisitions only (columns 3 and 4); or R&D plus advertising only (columns 5 and 6). *Single* is a dummy variable equal to 1 if the CEO is unmarried and 0 otherwise, X is a set of firm characteristics, and Y is a set of CEO characteristics (the specific variable definitions are given in §2), demeaned when used in interaction terms: $\tilde{Y} = Y - \hat{E}Y$. Industry × year fixed effects are based on the Fama–French 49-industry classification. The t-statistics are in parentheses and are computed using robust standard errors clustered by firm.

Column 1 of Table 3 shows that the *Single* coefficient is positive and statistically significant (t-stat. = 2.65). Its magnitude suggests an economically very meaningful effect of marital status: single CEOs invest 10.5% more than their married counterparts (given that the sample mean for total investment is 1.00). The coefficients on firm characteristics are consistent with the evidence documented in previous work. Firms with high cash flows, growth firms, small firms, and firms with high past investment tend to invest more.[12] These are well-known correlations, and the fact that they hold in our sample reassures us that it is similar to those documented in other studies.

Interestingly, the interaction coefficient between *Single* and *Age* is negative, which means that the impact of marital status on investment is less important for older CEOs. This result is consistent with the hypothesis that marriage impacts, rather than just reflects, CEO preferences and firm risk taking. If the driving force behind our results was purely a selection effect, whereby CEOs who prefer to stay single are fundamentally different (e.g., by being more risk tolerant) from those who marry, the effect of marital status would be less likely to decrease with age. In fact, it would likely increase, because at older ages the single group

[12] Our results do not change if we use investment during the previous CEO's tenure as a control instead of lagged investment.

would be predominantly populated by people with a particularly strong aversion to marriage, and thus by people who are especially risk tolerant. On the other hand, if marital status directly influences CEO preferences, there are many potential explanations that are consistent with the observed negative interaction coefficient between *Age* and *Single*. For example, older CEOs may have fewer consumption commitments; or, if single CEOs are less risk averse due to their competing in the marriage market, we would expect this tendency to be less pronounced for older CEOs, because presumably the benefits of a prospective future marriage are lower later in one's life.

Our results do not change if we add controls for firm region or if we use a different industry classification scheme. They also hold if we focus just on R&D and advertising expenditures (specification in column 5), which arguably capture firm risk taking more accurately because they are commonly perceived as representing especially risky activities. The results for net acquisitions reported in column 3 are somewhat weaker, likely because a lot of smaller firms do not make any acquisitions. It may also be influenced by a countervailing effect of diversifying acquisitions, which tend to reduce rather than increase firm riskiness. Similarly, we find that a firm's market leverage is higher if its CEO is single (not reported). This result is sometimes weaker than the findings for investment and volatility, probably because young, risky, fast-growing firms typically have no or very little debt.

Does institutional ownership mitigate the aggressive investment policy of single CEOs? The institutional holdings coefficient is positive and significant for total investment and acquisitions (and essentially zero for R&D and advertising). Interestingly, the coefficient is most significant for net acquisitions, so that firms where institutional investors hold larger stakes are more likely to engage in acquisitions. However, the coefficient on the interaction term between holdings and *Single* is not significant.

As mentioned before, we are not taking a stand in this paper on whether CEOs alter firm decisions to meet their own objectives or are just matched to firms along all their relevant characteristics. To explore how much of a role CEO–firm matching plays, we omit any firm characteristics from our regressions in specifications 2, 4, and 6. Consequently, we are comparing single and married CEOs just controlling for their personal characteristics. Under that specification, the *Single* coefficient for the total investment measure grows dramatically to 0.45 (from 0.09), with a t-statistic of 5.23. Similarly to the return volatility results in the previous section, these findings suggest that riskier firms are strongly associated with single CEOs, perhaps because these CEOs are more willing to accept risks. However, even when we control for this selection effect in specifications 1, 3, and 5, single CEOs still assume greater risks than married ones. Results in columns 1, 3, and 5 are probably more conservative estimates of the difference between married and single CEOs, to the extent that our (potentially imperfect) controls capture all of the relevant firm characteristics, whereas those in columns 2, 4, and 6 represent the most aggressive estimates. Our results all continue to hold if we add controls for CEO wealth and compensation (not reported).

It is not surprising that firms that invest more are also riskier. Are our results driven primarily by the selection effect, whereby CEOs of young, fast-growing firms tend to be single (even controlling for age and other observable characteristics) for reasons that are unrelated to risk? Unfortunately, we do not have enough observations of CEO marital status changes (or changes between married and single CEOs) to establish whether firm risk and investment also change when they occur. However, we can exploit the impact of within-firm variation in risk on investment to explore further the role of CEO marital status. Panousi and Papanikolaou (2012) find that an increase in idiosyncratic volatility decreases corporate investment, which is consistent with the effect of managerial risk aversion, since CEOs cannot hedge purely idiosyncratic (firm-specific) risk. The status model, which is one potential mechanism by which CEO marital status may influence firm risk taking, predicts that single CEOs have higher tolerance for idiosyncratic risk (a detailed description of the model is available on our websites). As a consequence, we should expect to see a much weaker effect of lagged idiosyncratic volatility of the firm's stock returns on investment among firms whose CEOs are single. To test this hypothesis, we estimate the following regression specification:

$$Investment_t = \alpha + \beta \times Single + \gamma \times IdVol_{t-1} + \delta \times (Single \times \widetilde{IdVol}_{t-1}) + \zeta \times X, \quad (2)$$

where $IdVol_{t-1}$ is lagged idiosyncratic volatility of the firm's stock returns, and X is a set of firm and CEO characteristics used as controls. Importantly, the latter includes firm as well as year fixed effects, as we are interested in within-firm effect of risk on investment. Results are reported in Table 4. Consistent with the evidence in Panousi and Papanikolaou (2012), we document a robustly negative and statistically significant effect of $IdVol_{t-1}$ on total firm investment, with coefficients of -0.175 without any controls other than fixed effects and around -0.330 when various combinations of controls are added, and t-statistics ranging between -3 and -6. Furthermore, although there is no statistically significant effect of *Single* itself on within-firm variation in investment, there is a strongly positive

Table 4 Effect of Idiosyncratic Risk on Investment

	1	2	3
$IdVol_{t-1}$	−0.175	−0.330	−0.289
	(−3.100)	(−5.940)	(−4.950)
Single	−0.043	−0.043	−0.026
	(−1.090)	(−1.110)	(−0.600)
$IdVol_{t-1} \times Single$	0.216	0.309	0.319
	(2.250)	(3.320)	(3.270)
CF_t		0.101	0.103
		(16.110)	(15.600)
M_{t-1}/B_{t-1}		0.207	0.199
		(21.240)	(19.610)
$\text{Log}A_{t-1}$		−0.334	−0.347
		(−15.680)	(−15.580)
$Leverage_t$		0.745	0.757
		(12.540)	(12.220)
$Investment_{t-1}$		0.082	0.074
		(12.690)	(10.970)
FirmAge		0.043	0.039
		(14.200)	(10.500)
Age			−0.003
			(−1.380)
Age × *Single*			−0.003
			(−0.450)
Tenure			0.001
			(0.170)
Tenure × *Single*			0.010
			(1.220)
CEOProminence			−0.019
			(−1.760)
FirmProminence			−0.013
			(−0.790)
Inst			0.337
			(4.650)
N	24,169	24,167	23,011
R^2	0.594	0.621	0.623

Notes. The table reports coefficient estimates of the following OLS regression:

$$Investment_t = \alpha + \beta \times Single + \gamma \times IdVol_{t-1} + \delta \times (Single \times \widetilde{IdVol}_{t-1}) + \zeta \times X,$$

where *Investment* is our measure of total investment in Table 3, *Single* is a dummy variable equal to 1 if the CEO is unmarried and 0 otherwise, $IdVol_{t-1}$ is lagged idiosyncratic volatility of the firm's stock returns, and X is a set of firm and CEO characteristics. All variables are demeaned when used in interaction terms (e.g., $\widetilde{IdVol}_{t-1} = IdVol_{t-1} - \hat{E}\,IdVol_{t-1}$). All specifications also include firm and year fixed effects. Robust t-statistics are in parentheses.

effect of the interaction between *Single* and the idiosyncratic volatility measure. This effect is essentially of the same magnitude as the effect of volatility itself, with coefficients ranging between 0.216 and 0.319 and t-statistics between 2.2 and 3.3. Therefore, for firms run by single CEOs, the total effect of these coefficients is effectively zero, implying that single managers are much less affected by changes in idiosyncratic risk than married ones, which is consistent with the hypothesis that marital status impacts managerial behavior. Whereas married CEOs strongly decrease investment in response to increases in idiosyncratic volatility, single ones do not alter their investment patterns. As in our previous tests, single managers are much less averse to (idiosyncratic) risk in a way that has a meaningful impact on firm investment.

3. Instrumental Variables Approach: Divorce Costs

Our results support the hypothesis that single CEOs assume more risk than married ones. It is also possible, however, that our results are not actually driven by CEOs' marital status but instead reflect their innate heterogeneity. For example, individuals who are single at a given age may be inherently more risk tolerant than those who are married by the same age. It would be possible to distinguish this scenario from the one in which marriage itself matters by exploiting changes in managers' marital status over time. Unfortunately, this would require a significant number of CEOs to experience marital status changes during their tenure and for us to be able to document such a transition. Moreover, we would need to have precise dates of these marital transitions, which are difficult to obtain.[13] Thus, we cannot convincingly distinguish our hypothesis from the alternative one that single and married CEOs are simply different using within-manager variation. Instead, to rule out the hypothesis of innate heterogeneity, we employ an instrumental variables approach described in the following section.

3.1. Community Property vs. Equitable Division

Whereas some of the variation in CEOs' marital status is likely driven by their luck or skill in finding a suitable marriage partner, some variation is probably due to the perceived costs of getting married. In particular, a nontrivial fraction of marriages, including those of CEOs, end in divorce. Since divorce is costly, this possibility should have an effect on an individual's propensity to enter into a marriage in the first place. For a wealthy person, a major concern is the division of property upon dissolution of a marriage. In the United States, the division of marital assets upon divorce is regulated at the state level. Consequently, we can exploit the variation in the divorce laws across states of CEOs' residences, because it is plausibly exogenous both to the match between a firm and a CEO and to the firms' investment opportunities.

The most salient aspect of heterogeneity in the laws guiding the division of marital property is the distinction between *community property* and *equitable division* standards. The former mandates equal division of

[13] We are able to find 76 CEOs in our sample who became married during their tenure, but for many of those, the marital status change occurred right after they became CEO or shortly before they stepped down (thus not allowing a proper comparison of managerial decisions before and after marriage).

all assets acquired during marriage between the two spouses upon divorce, regardless of how much each spouse contributed, whereas the latter follows the common law practice allowing the division to be determined by a judge based on a range of factors, including the relative contributions of the spouses. It is commonly understood that community property is more advantageous for the poorer spouse (see Voena 2011), and especially so for wealthy households. Since CEOs are typically substantially wealthier than their spouses, equal division of assets mandated by community property laws makes marriage costlier for them (as long as there is a positive probability of its dissolution).

There are nine states in the Unites States that have adopted the community property system: Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Texas, Washington, and Wisconsin.[14] Although community property legislation was adopted by these states at different points in time, it was in place in all of them throughout the period covered by our sample. Thus, there is little concern that political economy considerations could create an endogeneity problem, since it is highly unlikely that the passage of laws regulating divorce is systematically related to firms' investment opportunities and risk decades later. It is interesting to note that the use of the community property standard is not obviously related to (current) state characteristics. It is present in both rich and poor states, in large and small ones, as well as those whose populations' political preferences tend to be either predominantly liberal or predominantly conservative.

Although we do not directly observe the state of CEO residence, we can use the state in which the firm is headquartered as a reasonably good proxy for which type of jurisdiction is more relevant for the CEO.[15] Although the number of community property jurisdictions is small, it includes some of the most populous states in the United States and thus represents approximately 36% of our sample of CEOs.

A potential issue is that prospective CEOs who are married may choose to reside in certain states because their divorce laws are more friendly to wealthy individuals. The market for CEOs in states where divorce is more costly would then have a relatively greater supply of potential CEOs who are single. If these CEOs are also more innately risk tolerant on average, this could represent a problem for our instrument. However, given that the labor market for CEOs of public companies is likely nationwide, this would require divorce laws to be a significant factor in determining where potential CEOs seek employment, which we believe is not plausible. What our instrument relies on is the assumption that a state's legal regime can influence a single CEO's decision whether to get married at a given point in time. More specifically, a CEO who is currently single and resides in a community property state is more likely to postpone marriage, holding all else equal.

Prenuptial agreements may limit the extent to which community property statutes impose a cost on wealthy individuals who marry less wealthy spouses. However, even among the wealthy their adoption is by no means universal. A prenuptial agreement is costly—and not exclusively, or even primarily, just in terms of monetary costs. Moreover, full enforcement of premarital agreements by the courts is not always guaranteed.[16] To the extent that such agreements decrease the impact of state laws on the cost of divorce, and therefore on the probability of a single CEO getting married, this would only attenuate our first-stage estimates of the effect of community property states on CEO marital status and consequently weaken the statistical power of the instrument in the second stage. Mismeasurement of the relevant jurisdiction would have a similar effect, weakening our results. In an unreported external validation exercise for our divorce law instrument, we use U.S. census data to show that wealthy individuals are substantially less likely to be married in community property states.

3.2. Instrumental Variables Results

In the first stage, we regress the (potentially) endogenous variable *Single* on the instrumental variable, *Community*, which equals 1 if the firm is headquartered in a community property state and 0 otherwise, as well as all of the control variables that we use. Our specification is as follows:

$$Single = \alpha + \beta \times Community + \gamma \times X + \delta \times Y, \qquad (3)$$

where X is a set of firm characteristics, and Y is a set of CEO characteristics. We also include industry and year fixed effects, which we do not tabulate.

Table 5 reports the estimated coefficients in column 1. In accordance with our hypothesis, *Community* has a highly significant effect on the probability of a CEO being single, controlling for all of the firm and CEO characteristics (including, in particular, CEO age and wealth, both of which have predictably negative effects). Thus, variation in divorce laws represents a useful instrument for CEO marital status and, in fact, a rather strong one, as suggested by a t-statistic of 3.25

[14] Puerto Rico is also a community property jurisdiction.

[15] Although a number of CEOs of companies headquartered in New York City reside in Connecticut or New Jersey, both of these are also equitable distribution states, and so there is no error due to misclassification for these CEOs.

[16] A recent example where such an agreement was not upheld by the legal system in a community property jurisdiction is the high-profile divorce between Frank and Jamie McCourt (see Alton 2010 for more details).

Table 5 Instrumental Variable Results

	Single status	Idiosyncratic volatility	Total investment
	1	2	3
Community	0.046		
	(3.250)		
SinglePred		0.330	2.357
		(2.730)	(2.990)
CF_t	−0.001	−0.004	0.109
	(−0.320)	(−3.830)	(5.600)
M_{t-1}/B_{t-1}	0.001	0.001	0.096
	(0.290)	(0.520)	(7.070)
$\text{Log}A_{t-1}$	−0.016	−0.020	−0.128
	(−3.670)	(−7.490)	(−6.440)
$Leverage_t$	−0.011	0.079	0.292
	(−0.480)	(11.330)	(5.420)
$IdVol_{t-1}$	0.035	0.318	
	(1.620)	(6.670)	
$Investment_{t-1}$	0.008		0.456
	(2.640)		(18.780)
FirmAge	−0.002	−0.000	0.003
	(−3.680)	(−1.460)	(1.610)
Age	−0.003	0.000	−0.000
	(−4.050)	(0.470)	(−0.080)
Tenure	−0.002	0.001	−0.003
	(−1.630)	(1.400)	(−1.130)
Wealth	−0.019	0.002	0.071
	(−6.180)	(0.710)	(4.280)
CEOProminence	−0.022	0.011	0.076
	(−5.610)	(4.540)	(4.930)
FirmProminence	−0.002	−0.000	0.009
	(−0.660)	(−0.350)	(0.830)
Inst	0.033	−0.075	0.047
	(1.300)	(−5.000)	(0.570)
Payroll	0.069	0.108	0.641
	(0.100)	(0.350)	(0.270)
CEAI	−0.121	0.190	−1.448
	(−0.280)	(0.640)	(−0.770)
Log(*IncomeState*)	0.055	0.003	0.285
	(1.200)	(0.190)	(2.300)
N	22,402	24,189	22,402
R^2	0.110	0.444	0.450

Notes. The table reports coefficient estimates of the instrumental variables regressions. Column 1 presents estimates from the following OLS regression:

$$Single = \alpha + \beta \times Community + \gamma \times X + \delta \times Y + \zeta \times Z,$$

where *Single* is a dummy variable equaling 1 if the CEO is unmarried and 0 otherwise, *Community* is a dummy variable equal to 1 if the firm is headquartered in a community property state and 0 otherwise, X is a set of firm characteristics, Y is a set of CEO characteristics, and Z is a set of state-level control variables (the specific variable definitions are given in §§2 and 4.3). Columns 2 and 3 report coefficient estimates of the following OLS regression:

$$I = \alpha + \beta \times SinglePred + \gamma \times X + \delta \times Y + \zeta \times Z,$$

where I is either *IdVol* or total investment, *SinglePred* is the predicted value for *Single* computed using the appropriate first-stage specification, X is a set of firm characteristics, Y is a set of CEO characteristics, and Z is a set of state-level control variables (the specific variable definitions are given in §§2 and 4.3). All specifications also include industry (based on the Fama–French 49-industry classification) and year fixed effects (unreported). The t-statistics are in parentheses and are computed using robust standard errors clustered by state, taking into account the uncertainty in first-stage estimates.

(calculated using robust standard errors clustered at the state level). A CEO residing in a community property state is 4.6% more likely to be single relative to the unconditional probability of 16.2%.

We then repeat the regressions for return volatility and for firm investment (given by Equation (1)) using a two-stage least squares approach, where we substitute the fitted value from the first-stage regression described

above, *SinglePred*, for the endogenous variable *Single*. We report the results for our two main dependent variables: idiosyncratic stock return volatility and total firm investment (these results also extend to the other outcome variables that we used above). These second stage results are presented in columns 2 and 3. Each one of these uses the appropriate first-stage regression (i.e., with lagged volatility or investment as controls, rather than both as in column 1). The effect of the instrumented variable, *SinglePred*, is always strongly significant, regardless of specification, with t-statistics of 2.73 for idiosyncratic volatility and 2.99 for total investment (following the same specifications as in Tables 2 and 3, respectively).

One potential source of concern regarding our instrumental variables approach is the possibility that our instrument is systematically correlated with variation in firm investment opportunities across states. Most of the firms in our sample are fairly large companies operating at the national level so that the economic activity in the state where their headquarters are located is unlikely to drive their investment opportunities. Nevertheless, because we do not have data on the geographic composition of firms' investment, we cannot rule out this possibility directly. Instead, we attempt to control for state-level variation in investment opportunities using state-level macroeconomic variables.[17]

We use the following variables to capture state-level economic activity: the annual growth rate in nonfarm payroll employment (*Payroll*) and the in-state Coincident Economic Activity Index (CEAI) constructed by the Federal Reserve Bank of Philadelphia (*CEAI*), as well as the logarithm of real per-capita income (Log(*IncomeState*)). Our results are not altered by the inclusion of these controls. The only statistically significant state-level coefficient is that of Log(*IncomeState*) on investment, indicating that firms headquartered in states with higher per-capita income on average invest more. At the same time, the effect of the state-level economic activity index, although not statistically significant, is negative. We conclude that our instrumental variable results are not likely to be due to differences in economic conditions across states.

Overall, these results confirm that CEO marital status has an effect on firm risk taking. The instrumental variables approach helps rule out innate heterogeneity among CEOs that is correlated with marital status as an explanation of our results. It also potentially strengthens our results by reducing the effect of measurement error that arises from our classification of CEOs into "single" and "married."

[17] The ordinary least squares (OLS) results reported in §2 are robust to the inclusion of state fixed effects. Clearly, we cannot include these in the IV estimation due to the cross-sectional nature of our instrument.

4. Conclusion

In this paper, we explore the relationship between CEO marital status and firm risk taking. We find that single CEOs invest more aggressively (in capital expenditures, R&D, advertising, and acquisitions) and that their companies exhibit higher stock return volatility. These effects are not only statistically significant but also economically important. Our results are strengthened when we adopt an instrumental variables approach, based on variation in divorce laws across U.S. states. The instrumental variables results support the hypothesis that CEO marital status impacts firm risk taking rather than that the relation simply reflects innate heterogeneity in CEO preferences.

There exist a number of potential explanations for our findings, including changes in indirect preferences over wealth resulting from family formation, status concerns driven by marriage market competition, or direct biological effects of marriage on behavior. Distinguishing between the different channels through which marriage can alter risk tolerance of high-wealth individuals is a fruitful venue for future research. Whether one or several of these channels are at work, our findings have potentially wide-ranging implications, as differences in marriage norms across societies may help us understand the huge variation in management practices and, consequently, diverging patterns of economic growth (e.g., Bloom and Van Reenen 2010).

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2014.1926.

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