

# Are CEOs More Likely to be First-borns?<sup>1</sup>

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This version: January 2018

## Abstract

We investigate the link between birth order and the career outcome of becoming Chief Executive Officer (CEO) of a company. CEOs are more likely to be the first-born, i.e., oldest, child of their family. This result holds for family firms, where traditionally the oldest child is appointed to run the family business, but also for non-family firms. We also find that CEOs are significantly less likely to have older brothers (relative to younger brothers) than older sisters (relative to younger sisters). The advantage of being first-born seems to decay over time, consistent with changing family structures and rearing practices as well as changing social norms.

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<sup>1</sup> We thank the seminar participants at Birkbeck College, Imperial College, NOVA School of Business and Economics, University of Edinburgh, University of Piraeus, and University of Southampton for their comments. We also thank Sandy Black, Marcelo Fernandes, Raj Iyer, Matti Keloharju, Samuli Knüpfer, Raghu Rau, Julia Rohrer, Antoinette Schoar, Denis Sosyura, and Paolo Zafaroni for helpful comments. Geet Chawla and Zeca Cardoso provided excellent research assistance. We are grateful to Vistage, in particular Rafael Pastor, Leo Bottary, and Katie McWeeney, for continued support.

## **Introduction**

Drucker (1967) observes that the common characteristic of CEOs is that they “get the right things done” (Drucker (1967), p. 1). While research on CEOs has documented substantial heterogeneity in CEO characteristics, those that make it to the top indeed seem to share superior general ability and better execution skills (Kaplan, Klebanov, and Sorensen (2012)), while being more optimistic and less risk averse than the general population (Graham, Harvey, and Puri (2013)). These characteristics and ultimately an individual’s career outcome are likely shaped by a number of innate and pre-determined factors, many of which are still unknown. In this study, we explore CEOs’ birth order, including its interaction with the gender of CEOs’ siblings, as one pre-determined factor that might affect an individual’s career path.

Birth order has long played an important role for the leadership succession in family firms, reflecting traditional inheritance rules that favor the first-born child or, often specifically, the first-born son (primogeniture). However, it has not received much attention in more general studies of CEO selection. This might be surprising as first-borns have consistently been found to have higher IQ and better educational attainments due to a relatively more beneficial rearing environment (e.g., Behrman and Taubman (1986), Black, Devereux, and Salvanes (2005), Kristensen and Bjerkedal (2007), Rohrer, Egloff, and Schmukle (2015)). Both IQ and educational attainment are likely determinants of ability, which Kaplan et al. (2012) identify as the primary shared characteristic among those selected for the CEO position.

Birth order might also affect CEO selection through its possible effect on personality traits and risk preferences, as first proposed by Adler (1925). More recently, Sulloway (1996), and Black, Grönqvist, and Öckert (2017) suggest that first-

borns are more likely than later-borns to assume leadership positions as they are more conscientious, ambitious, persistent, and assertive. These traits are indeed consistent with execution skills, the second most important shared characteristic of CEOs identified by Kaplan et al. (2012). However, based on Sullivan's "Family Niche Theory" later-borns are more adventurous, open to experience, and risk seeking, as they have to find a family niche not yet occupied by older siblings. First-borns might therefore have less of an advantage in becoming CEOs in uncertain or risky environments or just for the fact that the role implies risk-taking decisions. Differently from the robust empirical evidence of an association between birth order and cognitive skills, research on the association between birth order and personality traits as well as risk preferences has yielded less consistent results. While Paulhus, Trapnell, and Chen (1999) and Gilliam and Chatterjee (2011) find support for the predicted association of birth order with personality traits and risk preferences respectively, Eckel and Grossman (2008), Rohrer et al. (2015), and Lehmann, Nuevo-Chiquero, and Vidal-Fernandez (2016) do not find any significant associations.

Since data on top executives' birth order is not readily available, we collect data from CEOs of small and medium size, privately held U.S. firms. The CEOs in our sample are members of Vistage, a U.S. based executive coaching company that organizes peer advisory groups for executives and business owners. Our main sample consists of about 150 CEOs who responded to a survey invitation included in Vistage's monthly newsletter between May and November 2013. Survey participants have provided detailed information about their family structures when growing up, as well as their own demographic and their firms' characteristics. An extended sample with

more limited information consists of about 600 CEOs who participated in the monthly WSJ/Vistage Small Business CEO Survey in November 2014.

Since our sample exclusively consists of CEOs, we examine the birth order frequency for CEOs in our sample and compare it to the probability of, for example, being first-born, if birth order did not affect the CEO selection. To avoid confounding effects due to family size, we estimate the expected proportion of first-borns in our sample using the number of siblings of the CEO. We exclude CEOs without siblings, as they are first- and last-borns at the same time. Given the evidence from population based studies (e.g., Kristensen and Bjerkedal (2007) and Black et al. (2017)) that birth-order effects depend on how children “were raised, not how they were born” (Sulloway (2007), p. 1711), we use the total number of siblings, including half-siblings and biologically unrelated siblings, which we obtained from our detailed CEO survey, when determining a CEO’s birth order. We use the term “family birth order” to differentiate our main approach from the biological birth order, which reflects the sequence of children of the same mother.

Based on our main sample, we find that CEOs are significantly more often first-borns than we would expect if there were no association between birth order and being selected as CEO. Specifically, the average difference between the observed proportion (45%) and the expected proportion (30%) of first-borns in our sample is 15 percentage points (pp). We further distinguish between family firms, for which the birth order is known to those making selection decisions, non-family firms, consisting of firms founded or acquired by the CEO as well as firms, which hired the CEO from the outside. The difference between observed and expected proportion of first-borns is particularly pronounced for CEOs of family firms (27 pp) and much smaller and not

statistically significant for founder CEOs (9 pp), consistent with traditional succession rules playing a role for family firms and risk and uncertainty being more pronounced for start-ups. Other firms, including the ones that hired the CEO from the outside, also show a positive and significant difference of 15 pp between the observed and expected proportion of first-borns. Finally, the difference is substantially larger (25 pp) for those that were first in a leadership position before 1990 compared to those who became CEOs only after 2000 (13 pp). The first-born advantage drops further and becomes insignificant for those that became CEOs after 2000 at an age below 40. These results are consistent with the first-born advantage decreasing over time.

We explore differences in gender and find that both female and male CEOs are more likely to be first-born children. However, the difference between observed and expected proportion of first-borns is smaller for women (9 pp) and, at least in our main sample, not statistically significant. Importantly, we find that the disadvantage of later-borns seems to depend on the gender of the earlier-born siblings. That is, CEOs in our sample are less likely to have older brothers relative to younger ones than to have older sisters relative to younger ones. Said differently, the advantage of being first-born reflects the absence of an older brother but not necessarily the absence of an older sister.

In our detailed survey of CEOs, we also elicit subjective expectations on the importance of birth order on career outcomes among CEOs of different birth order. While 65% of first-born CEOs believe that birth order played an important role for their career outcomes, only 43% of later-born CEOs share this opinion. We perform out of sample tests to evaluate the extent to which our finding of a first-born advantage to become CEO is due to sample selection, i.e., the possibility that first-

born CEOs are more likely to participate in our survey. We use our larger sample of about 600 CEOs, 98% of which answered a question related to their birth order as well as data from Black et al. (2017) to perform these tests. We find that in these larger samples the overall first-born advantage remains significantly positive, but becomes smaller, varying between 7 and 13 pp, which suggests to a large extent that our previous results cannot be explain by sample selection.<sup>2</sup>

Our study is related to a growing literature examining traits and characteristics of CEOs. Since Bertrand and Schoar (2003) initially documented a link between CEO heterogeneity and variation in corporate policies, several studies examine the effects of CEOs' personal or professional experiences or of specific traits on corporate decisions.<sup>3</sup> However, few studies in economics consider becoming CEO as a career outcome per se. Kaplan et al. (2012), Graham, Harvey, and Puri (2013), and Kaplan and Sorensen (2016) use data from surveys and executive search assessments of samples of 300 to 3,000 U.S. executives. They find that at the time of selection as CEO, CEOs have superior general skills, lower risk aversion, and higher optimism. Palaiou and Furnham (2014) survey about 150 CEOs as well as senior managers of UK firms and document that CEOs are relatively more extraverted, more agreeable, more conscientiousness, and less neurotic.<sup>4</sup> While all these studies document common characteristics and personality traits of those that are being or have been selected as

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<sup>2</sup> In a previous survey of 1,582 CEOs conducted by Vistage in 2007 with a response rate of 99.6%, 43.4% of CEOs report to be first-borns, while based on reported family size the expected proportion of first-borns is 34.3%, suggesting a first-born effect of 9.1 pp.

<sup>3</sup> See, for example, Faccio, Marchica, and Mura (2016), Cain and McKeon (2016), Custodio and Metzger (2014), and Dittmar and Duchin (2016).

<sup>4</sup> Green, Jame, and Lock, 2015 (2015) perform text analysis of earnings conference calls involving 4,000 U.S. CEOs and CFOs and determine that extraverted CFOs and CEOs are paid more and that extraverted CFOs are more likely to become CEOs.

CEOs, Adams, Keloharju, and Knüpfer (2016) perform predictive regressions of who will become a CEO using assessments from military exams of all Swedish men born between 1951 and 1978. They document significant, yet limited predictive power of cognitive and non-cognitive skills as well as height at age 18. By focusing on the role of birth order, we examine a specific aspect of the CEO's rearing environment, which is predetermined and not a reflection of other more fundamental CEO characteristics. Importantly, our estimated birth order effects do not reflect genetic or shared family characteristics, instead they reflect variation in the rearing environment, possibly related to different roles played by older and younger siblings when growing up, as well to differences in parental attention between first- and later-borns.<sup>5</sup> Others studies have examined the impact of early life experiences on CEOs' managerial practices and corporate policies. For example, Malmendier, Tate, and Yan (2011) show that CEOs who grew up during the Great Depression are averse to debt financing, while Bernile, Bhagwat, and Rau (2017) report an association between CEO's early-life exposure to natural disasters and corporate risk-taking later in life. Differently from these studies, we focus on CEOs' rearing environment and the career outcome of becoming a CEO.

Our results are also related to the literature on family firms (see, e.g., Holderness and Sheehan (1988), Anderson and Reeb (2003), Bertrand et al. (2008)). While Smith and Amoako-Adu (1999), Villalonga and Amit (2006), and Bennedsen et al. (2007) examine the succession in family firms, their focus is on the costs and

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<sup>5</sup> Price (2008) documents that first-borns receive 20 to 30 more minutes of quality time each day with their parents relative to second-born children of the same age from a similar family. In contemporaneous work on birth order, personality traits, and occupational outcomes, Black et al. (2017) also find birth order effect are largely determined by postnatal environmental factors, including parental investments in their children's human capital that decreases with birth order.

benefits associated with a family member being selected as the new CEO relative to an outsider. We find that the difference between the observed frequency and the expected probability of being first-born is particularly high for family firms relative to non-family firms. Our finding could offer a partial explanation of the negative performance effect associated with family successions, to the extent that it is due to primogeniture or elevated risk aversion of first-borns.

Finally, our study is related to a growing literature on the economic outcomes of birth order and family composition. While earlier research shows that birth order predicts IQ, educational outcome, and earnings (see, e.g., Behrman and Taubman (1986), Black et al. (2005), and Kristensen and Bjerkedal (2007)), our study is part of an emerging literature that specifically studies the effect of birth order on entrepreneurship, leadership, and career outcomes (see, Black et al. (2017), Keloharju, Knüpfer, and Tåg (2017), and Mishkin (2017)).

## **2. Data**

### **2.1. Survey of Vistage members**

We surveyed CEOs of small and medium size U.S. firms who are part of the Vistage network, a U.S. based executive coaching company that organizes peer advisory groups for executives and business owners. An invitation to participate in our survey on birth order was included in Vistage's monthly newsletter between May and November 2013. The newsletter was sent via email to about 12,000 Vistage members, approximately 2,000 of which were CEOs at the time. To participate in the survey,

respondents had to click on a link included in the newsletter.<sup>6</sup> The survey was directed at CEOs, and the topic of the survey was disclosed in the newsletter, but all newsletter recipients could participate. After dropping 29 responses from participants that are not CEOs, we are left with 160 survey responses, representing a response rate of 8%, relative to the number of CEOs included among the email recipients, and in line with other recent CEO surveys (see, e.g., Graham, Harvey, and Puri (2013)). We further drop responses from CEOs of extremely small firms, i.e., firms with less than two employees or less than 1,000 USD of annual revenue (9 observations), as well as responses with incomplete or inconsistent information about birth order and family size (3 observations). Finally, we drop CEOs who grew up without any siblings (7 observations). Our final sample includes responses from 141 CEOs, of which 110 are male and 31 are female. While this small sample serves as our main data set for our empirical analysis below, we also have responses to one survey question about an individual's birth order from 599 CEOs who participated in the monthly WSJ/Vistage Small Business CEO Survey in November 2014. Vistage, in collaboration with the Wall Street Journal, conducts a monthly survey among CEOs who are Vistage members to capture economic conditions from the perspective of small U.S. business. In November 2014, 791 individuals participated in the WJS/Vistage survey, 98% of which responded to the question "What is your birth order?" that Vistage included on our behalf. Based on occupational information, which Vistage provided together with respondents' year of birth, we identified 587 of the respondents as CEOs.<sup>7</sup>

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<sup>6</sup> The invitation link was member specific and members could only participate in the survey once.

<sup>7</sup> We have no information regarding the overlap between our two samples, as we have no identifiable information on survey participants.

## **2.2. Summary statistics**

Table 1 provides summary statistics for our main data set. In our sample 45.4% of the CEOs are the oldest child in their family. The average number of all siblings, including biological as well as non-biological siblings, is 2.93. For comparison, 53% are first-borns with respect to their biological mother, and the average number of siblings from the same mother is 2.38.

Most CEOs in our sample are male (78%). On average, CEOs were 51 years old in 2012 and first became CEO at the age of 39. The average total compensation, including stock options, bonus, and dividends, of the CEOs in the sample is about 430,000 USD in 2012.

Out of all firms represented by the CEOs in our sample 22% are family firms, while 34% of firms were founded by the current CEO and 10% were acquired by the current CEO. The remaining firms (35%) hired the current CEO, either directly as CEO (7%) or initially for a different, non-CEO position (28%).

The average 2012 revenue of the firms run by CEOs in our sample is 24 million USD and the average number of employees is 83. The average ROA as reported by the CEOs for the 2010-2012 period is 9.54%, and the average revenue growth for the same period is 7.12%.

## **3. Are CEOs more likely to be first-borns?**

To answer the question whether CEOs are more likely to be first-borns, we first compare the CEOs' birth order distribution with the distribution of birth order implied by the size of the families, in which CEOs grew up. Results are shown in Panel A of Table 2. We find that 45.4% of CEOs in our sample are first-borns, that is, the oldest

child in the family while growing up, while the expected proportion of being the oldest child, given the size of the family, is only 30.3%. This means that a CEO in our sample is 14.6 pp more likely to be first-born than what is implied by the size of their family and the assumption that birth order does not affect the chances of becoming CEO. The results in Panel A also suggest that CEOs are about 8 pp less likely to be second-borns. A Chi-square test for the difference in distributions between our sample and the distribution implied by family size and CEO assignment, which is independent of birth order, reveals that this difference is statistically significant at the 1% level.

In Panel B, we focus on the observed and expected proportion of first-born CEOs only, reporting results for all CEOs and by gender. As in Panel A, we calculate the expected proportion of first-borns using the number of all siblings of the CEO. For instance, for a CEO with one sibling the probability of being the first-born or oldest child is 0.50, for a CEO with two siblings it is a third, and so on. More formally, for each CEO we calculate the expected probability of being the oldest child as  $P(\text{being the oldest child} | \text{siblings} = n) = 1/(n+1)$ , where  $n$  is the number of siblings. We then compare the observed proportion of CEOs, who are first-borns, to the average expected probability. The results reveal that the difference of 15 pp between the observed and expected proportion across all CEOs is statistically significant. When repeating the test by gender, we find that the observed proportion of first-born CEOs is larger for man than for woman (47% vs. 39%), and so is the difference between observed and expected proportion (17 pp vs. 9pp). The difference between observed and expected proportion of first-born CEOs is not significant for women in this specification.

Since birth order effects seem to be social as opposed to biological (e.g., Kristensen and Bjerkedal (2007); Black et al. (2017)), we focus on the total number of siblings, including half-siblings and biologically unrelated siblings. However, when considering biological birth order, that is, only siblings from the same mother, we find results similar to those reported in Table 2, with the only exception being that we find a significant first-born advantage for male as well as female CEOs in case of biological birth order (see Appendix Table A1 for details).

Overall, we find that CEOs are more likely to be first-born than they would be if birth order did not affect the likelihood of becoming CEO.

#### **4. Subsample results**

##### **4.1. Birth order and CEO characteristics**

To analyze cross-sectional variation in the probability of being a first-born CEO, we repeat our analysis for a number of subsamples based on CEO characteristics, namely education, age, and the year when an individual first became CEO. Table 3 shows the results.<sup>8</sup>

Panel A reports results related to CEO education. Previous literature shows that first-borns achieve higher levels of education (see, for instance, Black et al. (2005), Booth and Kee (2009) and Haan (2010)). We find a non-monotonic relation between education and birth order effects. Being first-born seems relevant for CEOs across all education levels, but more important for the ones with a graduate degree. The difference between observed and expected proportion of first-borns in the

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<sup>8</sup> As before, we use self-reported number of siblings, including non-biological ones to calculate expected proportion of first-borns, and we exclude singletons.

sample is the highest for CEOs with a graduate degree (23 pp) or just high school (16 pp), and the lowest for CEOs with a college degree. Overall, the link between birth order and education is not clear in our sample. However, because there might be selection effects among later-born CEOs it is not clear whether we should expect a larger proportion of first-born CEOs to be more educated.

Panel B of Table 3 reports results for different age groups. We find that CEOs younger than 50 are more likely to be first-borns, with difference between the observed and the expected proportion being 9.7 pp. CEOs that are more than 50 years old are also more likely to be first-borns, but the difference between observed and expected probability is larger at 20.7 pp. There seems to be an age effect in the role of birth order. One possible explanation for the age effect is that younger CEOs are more likely the ones that founded their own company and are therefore more comfortable with taking risks. At least some prior research suggests a positive relation between risk taking and birth order, and we might therefore expect founders to be of a relatively higher birth order.

The described age effects might also capture changes in the effect of being the first-born over time, for example due to changing social norms. To separate an age effect from a cohort effect, in Panel C we use the year when a CEO first became CEO to define their cohort. We find that the difference between observed and expected proportion of first-borns is indeed decreasing over time. For those who first became CEOs during and before the 1980s the difference is 25 pp, while for those who became CEOs during the 2000s the difference is 13 pp. In fact, in Panel D, we link CEO cohorts with the age at which they became CEO and find that the largest difference between observed and expected proportion of first-borns is for CEOs who became such before

the 2000s at an age older than 40. In this group the proportion of first-borns is the highest at 55%, with an expected proportion of only 29%. For CEOs that got appointed after 2000 and at an age younger than 40 the difference between observed and expected proportion of first-born is the lowest at 10 pp and not statistically significant. These results are consistent with being the first or oldest child becoming less important over time for becoming a CEO as a career outcome.

#### **4.2. Birth order and firm characteristics**

In Table 4, we analyze the probability of being a first-born CEO across different types of firms. In Panel A, we distinguish between family firms, which might be particularly likely to select first-born as CEOs, firms founded or acquired by the current CEO, and other firms, which hired the CEO from the outside, either directly as CEO or initially for another position. For family firms, birth order is very likely known to those selecting the CEO, and traditional succession norms favor the oldest child, in particular the oldest son (see, for instance, Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon, 2007). As expected, we find that CEOs are particularly more likely to be first-born in family firms compared to all other firm types. The difference between the observed and expected probability of being the oldest child is 27 pp across all family firms, and 45 pp for family firms when the CEOs was initially appointed before 2000. However, family firms do not fully explain our baseline result. The difference between observed and expected proportion of first-borns for CEOs that were appointed/promoted by the firm (“other firms”) is still 15 pp and statistically significant.

Founder CEOs are a particularly interesting case because two mechanisms associated with birth order, cognitive ability and risk aversion, might be at play. On the one hand, and consistent with the results for the overall sample, founder CEOs

can be more likely to be of lower birth order because starting and developing a business requires cognitive ability and talent.<sup>9</sup> On the other hand, starting a firm is risky, so that we should expect founder CEOs to be less risk averse and therefore of a higher birth order. We find that founder CEOs are less likely to be first-borns than CEOs of family firms, CEOs that acquired the company, or CEOs that were appointed/promoted by the firm. In fact, the difference between observed proportion and expected proportion is only 9 pp and not statistically significant for founders. This is in line with higher-born siblings being less risk averse than first-borns and for this reason more likely to start their own company. Similarly, we find that the first-born advantage among CEOs that acquired the firm is relatively low as well (12 pp) and not statistically significant either.

In Panel B of Table 4, we look at firms of different sizes, based on the number of employees or revenue. The lowest difference between observed and expected proportion of first-borns is for small firms measured by number of employees (<25 employees) and small and medium size firms when revenue is considered (<\$19 million). We also find that when size is measured by revenue, the difference is largest for large firms (>\$19.18): 51% of CEOs of the largest large firms in the sample are first born, while the expected proportion is only 34%. The fact that first-born CEOs are more likely to run medium/larger firms might be linked to superior skills, assuming positive assortative matching between CEO ability and firm size as suggested by Gabaix and Landier (2008), or higher risk aversion. First-borns tend to have higher

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<sup>9</sup> Adams, Almeida, and Ferreira (2009) find a positive effect of founder CEOs on firm performance.

cognitive ability and be more risk averse than later-borns and therefore might self-select into larger and therefore less risky firms.

## **5. Rearing environment**

Given the existing evidence that birth order affects cognitive ability through a social mechanism within the family as opposed to a biological mechanism, we explore variation in CEOs' family and rearing environment that might play a role in the birth order effect on becoming a CEO. In particular, we examine family size, the level of parents' education, as well as the age and gender of siblings. Table 5 shows the results.

Family size can confound birth order effects, given that higher birth orders can be observed only in larger families and that in the cross section, family size likely varies with other relevant family characteristics. Because we use a within-family approach to estimate the expected proportion of being first-born, family size or correlated family characteristics do not explain our previous results. However, family size could also correlate with the characteristics of the first-born child. For instance, parents might have more or fewer children based on the abilities and endowments of the first child. Specifically, imagine the first child's abilities exceed the parents' expectations and lead to more children than the parents would have had otherwise. If parents' initial expectations were correct and the first child exceeds the abilities of the younger siblings, the difference between observed and expected proportion of first-borns statistic would be biased upwards, as the expected probability of being first-born would be lower exactly in those cases where the first-born child has superior skills and is more likely to become a CEO. The opposite effect would hold if lower ability first-

borns caused more children. While we cannot completely rule out such family size effects, we can test whether birth order is particularly relevant for small or for large families.

In Panel A, we explore variation in family size and find that being first born is more important in small families. The difference between observed and expected proportion of first-borns is largest for families with three or fewer children (19 pp) and smallest, and insignificant, for families with six or more children (5 pp). Being first-born seems to make a difference as long as family size is not too large. This result mitigates the concern that family size is endogenously related to the observed quality of first-borns, which could explain the difference between observed and expected proportion of first-born CEOs.

In Panel B, we compare the observed and expected proportion of first-born CEOs across families with different social backgrounds proxied by parent's highest education level. We find that CEOs are more likely to be first-born children than expected if their parents have a college degree or less. When parents have a graduate degree, the difference between observed and expected probability of being first-born is small (7 pp) and not statistically significant. The result on parents educational background is consistent with the idea that siblings have to share limited resources: in families with better social background, which are expected to have better resources, there should be less of a first-born advantage.

In Panel C, we address a different, but related question: Are CEOs more likely to be the first-male-born or first-female-born child in their families than what we can expect given the number of male or female siblings? We find that CEOs are 16 pp more likely than expected to be the first-male-born child of their families. However, we do

not find this to be the case for female CEOs. Female CEOs are slightly less likely to be the first-female born child in their families than what is expected, but this difference is not statistically significant.

Last, in Panel D of Table 5, we compare the proportion of CEOs that have a younger brother to the proportion of CEOs that have an older brother. Similarly, we compare the proportion of CEOs that have a younger sister to the proportion of CEOs that have an older sister. While older brothers are 26 pp less likely than younger brothers, the difference between older and younger sisters is only 6 pp and statistically insignificant. Finally, we compare the difference between these two differences (20 pp) and find that it is indeed statistically significant, that is, CEOs are more likely to have a younger vs. older brother compared to a younger vs. older sister. When looking at male and female CEOs we find the same pattern, i.e., older brothers are relatively less likely than older sisters, by 19 pp for male CEOs and by 23 pp for female CEOs. However, given the small number of female CEOs, this difference is not statistically significant in the case of female CEOs.

Overall, being first-born seems to play a more important role among smaller families, and when parents have attained all but the highest level of formal education. We also find that male CEOs are more likely to be the oldest male, while female CEOs are not more likely to be the oldest female. Finally, we document an important interaction between CEOs' birth order and the gender of their siblings: CEOs are much more likely to have younger vs. older brothers relative to younger vs. older sisters.

## **6. Discussion**

### **6.1. CEOs' perceptions of the importance of birth-order**

Our results so far are consistent with birth-order influencing career paths and the outcome of getting to the top. We asked the CEOs in our sample about their perception of the importance of birth order for their career outcome. Table 6 shows the results. 54% of the CEOs believe birth order has contributed to them becoming CEOs. Interestingly, 65% of first-borns believe that birth order mattered, while only 43% of later-borns believe so.

This difference between first- and later-borns raises the concern that we might have oversampled first-born CEOs, since we specifically ask them to answer a survey about birth-order, and they seem to be more aware of potential effects of birth order. We address this concern with two out-of-sample tests.

## **6.2. Out-of-sample evidence**

In the first out-of-sample test, we use birth order information for 599 CEOs that participated in the WSJ/Vistage Small Business CEO Survey in November 2014. While this larger sample is virtually free of sample selection concerns, given a response rate of 98%, we only have data on CEOs' biological birth order, i.e., whether they were first, second, third and so on child of their biological mother and their year of birth, but no additional information.

Importantly, we do not know how many siblings a CEO has. Therefore, we cannot drop CEOs without siblings, nor can we calculate the expected probability of being first-born given the number of siblings. Instead, we use data for the U.S. population as a whole, corresponding to a CEO's year of birth. Specifically, we obtain the proportion of live births by (biological) birth order in a given year from the "Vital

Statistics Birth Data” of the National Center for Health Statistics (NCHS).<sup>10</sup> Then, we compare the birth order distribution observed in our CEO sample with the birth order distribution observed for the U.S. population. Table 7 Panel A reports the comparison between the two distributions, revealing a significant ( $p$ -value: 0%) difference between both distributions overall as well as difference in the observed and the expected proportion of first-born CEOs of 10 pp.<sup>11</sup>

Panel B further shows that this difference of 10 pp is statistically significant. The results by gender also reveal a larger and statistically significant first-born effect for female CEOs (14 pp) compared to the effect for male CEOs (9 pp).

While the out-of-sample first-born advantage is smaller than in our smaller data set, the comparison is not straightforward given the differences between both approaches. For comparability between the large and small sample results, we therefore also reproduce corresponding results, that is, using biological birth order, including CEOs without siblings, and using U.S. population benchmarks, for our small sample. We report these results in Appendix Table A2. The comparable first-born advantage in our small sample is 21 pp.

Overall, our first out-of-sample test results confirm that CEOs are more likely to be the first child in their families. However, they also suggest that the effect might be smaller than what it is measured in our original birth-order survey.

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<sup>10</sup> Data from 1968 to 2015 is obtained through NBER, data from 1940 to 1967 is obtained from the National Center for Health Statistics reports. We assume that the birth order distribution prior to 1940 is the same as the one in 1940.

<sup>11</sup> Note that size of the first-born effect is very similar to the one found in a 2007 survey of 1,582 CEOs by Vistage with a response rate of 99.6%. In that survey, 43.4% of CEOs report to be first-borns, while based on reported family size the expected proportion of first-borns is 34.3%, suggesting a first-born effect of 9.1%. Unfortunately, detailed records from that survey are no longer available.

In our second out-of-sample test, we use summary statistics and regression results reported by Black et al. (2017) for data from Swedish population registers. Their sample includes only males from families with at least two male children. We again compare the observed proportion of first-born CEOs (top managers in their designation) to the proportion implied by the population statistics.<sup>12</sup> In Table 8, we report a difference between the observed and expected proportion of first-borns of 11 pp. Using reported regression results, we adjust this difference for the effect of family characteristics, such as family size, which are control for by family fixed effects. Doing so, we obtain a more conservative estimate of 8 pp for the difference between the observed and expected proportion of first-borns.

## **5. Conclusion**

We analyze a sample of CEOs of small and medium companies in the U.S., and we find an association between being first-born and becoming CEO. The CEOs of firms in our sample are significantly more likely to be first-born, i.e., the oldest child in the family when growing up, than what is expected given their own family size. While the first-born effect is particularly pronounced for family firms, which traditionally appoint the oldest child to run the family business, family firms do not solely explain our results.

When looking at cross-sectional variation due to CEO and firm characteristics, we find that founder CEOs are less likely to be the first child when compared to CEOs that are not the founders. We also document that larger firms in our sample are the ones more likely to be run by first-born CEOs. These results are consistent with first-

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<sup>12</sup> See Appendix Table A3 for details for how we make inference about the observed and implied proportion of first-born CEOs using summary data from Black et al. (2017).

born children not only being more talented, but also more risk averse than later-borns and therefore less likely to start their own firms or to run a smaller and riskier businesses.

Since the set of female CEOs is small, we cannot draw definite conclusions about differences between male and female CEOs with respect to a first-born advantage. However, we find an important interaction between CEOs' birth order and the gender of their siblings. CEOs are significantly less likely to have an older vs. younger brother than to have an older vs. younger sister. That is, the first-born advantage might largely reflect the absence of an older brother.

We also find evidence consistent with the first-born effect being more important for earlier CEO cohorts than more recent ones, consistent with changing family structures and rearing practices as well as changing social norms.

We address concerns about over-sampling first-born CEOs in our main sample by looking at two larger data sets that are essentially free from sample selection. We find a smaller, yet still economically large and statistically significant effect in both larger data sets. Finally, we also note that concerns about sample selection in our main sample are less likely to affect our cross sectional results, such as differences across firm types, cohorts, or rearing environments.

Overall, our results suggest that predetermined early life experiences, as captured by birth order, have a long lasting effect in people's professional careers, such as becoming the CEO of an organization.

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**Table 1. Summary statistics**

This table shows summary statistics for the sample of 141 CEOs. All CEOs in this sample have at least one sibling, including non-biological siblings. *N* denotes the number of observations.

Variable	<i>N</i>	Mean	Std. Dev.	Min	Max
First-born indicator: From same family	141	0.45	0.50	0.00	1.00
Number of siblings: All	141	2.93	1.87	1.00	11.00
Male indicator	141	0.78	0.42	0.00	1.00
Current age	138	50.96	9.18	27.00	78.00
Age first became CEO	135	38.64	9.42	19.00	68.00
Founder indicator	139	0.34	0.47	0.00	1.00
Acquirer indicator	139	0.10	0.30	0.05	1.55
Ownership in firm (in %)	135	46.52	38.83	0.00	100.00
CEO's income (2012, in million USD)	137	0.43	0.38	0.05	1.55
Family firm indicator	139	0.22	0.41	0.00	1.00
Other firm indicator	139	0.35	0.48	0.00	1.00
Revenue (2012; in million USD)	140	24.18	32.99	1.50	150.00
Number of employees (FTE)	140	82.66	101.14	2.00	450.00
ROA (3-year average, 2010-12, in %)	117	9.54	6.51	0.00	25.00
Revenue growth (3-year CAGR, 2010-12, in %)	132	7.12	20.79	-57.50	52.50

## Table 2. Baseline results

Panel A shows a chi-square test of the difference in distribution by birth order for the sample of 141 CEOs and the distribution by birth order implied by family size. The sample excludes singletons. Birth order corresponds to the family birth order, i.e., the order of birth of siblings of the same family, including biological siblings, half siblings, and adopted siblings. Panel B shows a test of the observed proportion of first-borns against the expected proportion given the family size, which for a given CEO is calculated as  $1/(n+1)$ , where  $n$  is the number of siblings, including non-biological siblings.  $N$  denotes the number of observations, and  $z$  denotes the z-statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

### Panel A: Distribution of family birth order

	Frequency		Proportion		Difference
	Observed	Expected	Observed	Expected	
Birth order: First	64	42.8	0.454	0.303	0.146
Birth order: Second	32	42.8	0.227	0.303	-0.081
Birth order: Third	24	28.8	0.170	0.204	-0.039
Birth order: Fourth	8	13.8	0.057	0.098	-0.034
Birth order: Fifth	8	6.5	0.057	0.046	0.015
Birth order: Sixth or higher	5	6.3	0.035	0.045	-0.006
Number of observations	141	141			
Goodness of fit: $\chi^2$ ( <i>p-value</i> )	17.08 (0.004)				

### Panel B: Proportion of first-borns

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
First-born CEOs	141	0.454	0.303	0.150	3.885
First-born CEOs: Female	31	0.387	0.296	0.091	1.112
First-born CEOs: Male	110	0.473	0.306	0.167	3.805

**Table 3. Proportion of first-born CEOs: CEO characteristics**

This table shows the observed and expected proportion of first-borns by CEO characteristics. The sample excludes singletons. First-born corresponds to the oldest child among all siblings within a family, including non-biological ones. For a given CEO, the expected proportion is calculated as  $1/(n+1)$ , where  $n$  is the number of siblings, including non-biological siblings. In Panel A, CEO education corresponds to the highest degree attained. In Panel B, age is the CEO's age in 2012. In Panel C, CEO cohort is defined by the year the CEO first became CEO in any firm. In Panel D, age refers to the age at the time the CEO first became CEO.  $N$  denotes the number of observations, and  $z$  denotes the z-statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

**Panel A: By CEO education**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
High school	24	0.458	0.299	0.159	1.701
College degree	61	0.371	0.292	0.079	1.375
Graduate degree	55	0.545	0.319	0.227	3.674

**Panel B: By CEO age in 2012**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
<= 50 years old	71	0.415	0.319	0.097	1.670
> 50 years old	64	0.493	0.286	0.207	3.910

**Panel C: By CEO cohort**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
Became CEO before 1989	15	0.533	0.284	0.249	2.143
Became CEO between 1990-2000	32	0.469	0.313	0.156	1.903
Became CEO after 2000	94	0.436	0.303	0.133	2.799

**Panel D: By CEO cohort and age when first becoming CEO**

		Proportion First-born			
	<i>N</i>	Observed	Expected	Difference	<i>z</i>
Became CEO before 2000 @ age > 40	11	0.545	0.292	0.254	1.851
Became CEO after 2000 @ age > 40	56	0.464	0.299	0.165	2.706
Became CEO before 2000 @ age < 40	36	0.472	0.307	0.165	2.147
Became CEO after 2000 @ age < 40	29	0.414	0.316	0.097	1.128

**Table 4. Proportion of first-born CEOs: Firm characteristics**

This table shows the observed and expected proportion of first-borns by firm characteristics. The sample excludes singletons. First-born corresponds to the oldest child among all siblings within a family, including non-biological ones. For a given CEO, the expected proportion is calculated as  $1/(n+1)$ , where  $n$  is the number of siblings, including non-biological siblings. In Panel A, firms are classified as family firms, founded or acquired by the CEO, or other firms, which hired the CEO from the outside either directly as CEO or initially for another position, as reported by the CEO. In Panel B, size is measured using the number of employees or revenue in 2012.  $N$  denotes the number of observations, and  $z$  denotes the z-statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

**Panel A: By firm type**

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
Family firm	30	0.600	0.330	0.270	3.145
- Family firm & Became CEO <2000	10	0.800	0.353	0.447	2.955
- Family firm & Became CEO >=2000	19	0.526	0.325	0.202	1.878
Founded by the CEO	47	0.383	0.292	0.091	1.372
Acquired by the CEO	14	0.429	0.307	0.121	0.985
Other firms	48	0.458	0.304	0.154	2.326

**Panel B: By firm size**

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
# of Employees <=25	46	0.435	0.321	0.114	1.658
# of Employees >25 and <=75	49	0.510	0.300	0.210	3.204
# of Employees >75	45	0.422	0.294	0.129	1.895
Revenue <= 6.34	46	0.457	0.311	0.145	2.125
Revenue >6.34 and <=19.18	47	0.404	0.263	0.141	2.193
Revenue >= 19.18	47	0.511	0.340	0.171	2.471

**Table 5. Rearing environment**

Panels A and B in this table show the probability of being first-born by family size and parents' education level. The sample excludes singletons and First-born corresponds to the oldest child among all siblings within a family, including non-biological ones. Panel C shows the proportion of first-male-born and first-female-born against its expected proportion. Panel D shows mean differences in the observed frequency of younger and older siblings. *N* denotes the number of observations.

**Panel A: By family size**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
# of siblings <=2	73	0.589	0.397	0.192	3.349
# of siblings >2 and <=4	47	0.362	0.231	0.131	2.174
# of siblings >4	21	0.190	0.140	0.050	0.666

**Panel B: By parents' education**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
High school or less	48	0.458	0.319	0.139	2.066
College degree	61	0.492	0.290	0.201	3.464
Graduate degree	30	0.367	0.297	0.070	0.834

**Panel C: First female/male born**

	<i>N</i>	Proportion First-born			<i>z</i>
		Observed	Expected	Difference	
First-Female-Born	31	0.548	0.578	-0.030	-0.333
First-Male-Born	110	0.700	0.536	0.164	3.447

**Panel D: Younger and older brothers and sisters**

	All (N=141)	Male CEO (N=110)	Female CEO (N=31)
		Mean	
Younger brother indicator	0.574	0.573	0.581
Older brother indicator	0.319	0.300	0.387
Difference	0.255	0.273	0.194
t-stat	(4.041)	(3.861)	(1.360)
Younger sister indicator	0.461	0.473	0.419
Older sister indicator	0.404	0.391	0.452
Difference	0.057	0.082	-0.032
t-stat	(0.852)	(1.084)	(0.226)
Difference in differences	0.199	0.191	0.226
t-stat	(2.631)	(2.295)	(1.270)

### Table 6. Perceived importance of birth order

Table shows the survey answers to the question: "Do you believe your birth order contributed to your becoming CEO or, if not the CEO, obtaining your current position?" *N* denotes the number of observations.

#### Birth order contributed to career outcome:

	<i>N</i>	Yes	No
All CEOs	139	54%	46%
First-borns CEOs	69	65%	35%
Not First-borns CEOs	70	43%	57%
Independence: $\chi^2$ ( <i>p</i> -value)	6.99 (0.008)		

**Table 7. Baseline: Out of sample evidence using larger CEO sample**

This table shows the baseline test for a sample of 587 CEOs. The sample includes singletons, and first-born corresponds to the oldest child among the siblings of the same biological mother. For a given CEO the expected proportion of first-born is given by the birth order distribution of the U.S. Population based on the year of birth of the CEO. Panel A shows a chi-square test of the difference in the observed and expected distributions by birth order. Panel B shows a test of the observed proportion of first-borns against the expected proportion.  $N$  denotes the number of observations, and  $z$  denotes the z-statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

**Panel A: Birth order**

	Frequency		Proportion		Difference
	Observed	Expected	Observed	Expected	
Birth order: First	244	186	0.416	0.318	0.10
Birth order: Second	173	156	0.295	0.267	0.03
Birth order: Third	96	103	0.164	0.175	-0.01
Birth order: Fourth	37	59	0.063	0.101	-0.04
Birth order: Fifth	22	33	0.037	0.056	-0.02
Birth order: Sixth or higher	15	50	0.026	0.084	-0.06
Number of observations	587	587			
Goodness of fit: $\chi^2$ ( $p$ -value)	55.89 (0.000)				

**Panel B: First-borns by gender**

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
First-born CEOs	587	0.416	0.318	0.097	5.099
First-born Female CEOs	67	0.448	0.312	0.136	2.401
First-born Male CEOs	520	0.412	0.318	0.093	4.557

**Table 8. Baseline: Out of sample evidence using data from Black et al. (2017)**

This table shows the baseline test for a sample of 3,917 male CEOs (top managers) from Black et al. (2017). The sample excludes singletons, and a first-born corresponds to the oldest child among the siblings of the same biological mother. For a given CEO, the expected proportion of first-born is given by the birth order distribution in Black et al.'s sample of 727,111 males.  $N$  denotes the number of observations, and  $z$  denotes the  $z$ -statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

	Proportion First-born				
	$N$	Observed	Expected	Difference	$z$
First-born Male	3,917	0.479	0.369	0.110	14.267
First-born Male (adjusted for family fixed effects)	3,917	0.447	0.369	0.079	10.117

## **Are CEOs More Likely to be First-borns?**

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**Internet Appendix**

**Table A1. Baseline results: biological birth order excluding singletons**

Panel A shows a chi-square test of the difference in distribution by birth order for the sample of 134 CEOs and the distribution by birth order implied by the number of biological siblings of the same mother. The sample excludes singletons. Birth order corresponds to the biological birth order, i.e., the order of birth of siblings of the same mother, excluding half siblings, and adopted ones. Panel B shows a test of the observed proportion of first-borns against the expected proportion given the number of siblings of the same mother, which for a given CEO is calculated as  $1/(n+1)$ , where  $n$  is the number of biological siblings of the same mother.  $N$  denotes the number of observations, and  $z$  denotes the z-statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

**Panel A: Birth order**

	Frequency		Proportion		Difference
	Observed	Expected	Observed	Expected	
Birth order: First	65	44	0.485	0.327	0.159
Birth order: Second	31	44	0.231	0.327	-0.095
Birth order: Third	21	26	0.157	0.196	-0.039
Birth order: Fourth	7	11	0.052	0.081	-0.029
Birth order: Fifth	7	4	0.052	0.033	0.019
Birth order: Sixth or higher	3	5	0.022	0.037	-0.014
Number of observations	134	134			
Goodness of fit: $\chi^2$ ( $p$ -value)	18.74 (0.002)				

**Panel B: First-borns by gender**

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
First-born CEOs	134	0.485	0.327	0.159	3.914
First-born Female CEOs	30	0.500	0.326	0.174	2.039
First-born Male CEOs	104	0.481	0.327	0.154	3.348

**Table A2. Baseline results: biological birth order including singletons**

Panel A shows a chi-square test of the difference in distribution by birth order for the sample of 148 CEOs and the distribution by birth order implied by the US population in the year of birth of the CEO. The sample includes singletons. Birth order corresponds to the biological birth order, i.e., the order of birth of siblings of the same mother, excluding half siblings, and adopted ones. Panel B shows a test of the observed proportion of first-borns against the expected proportion given the birth order distribution in the US population in the year when the CEO was born.  $N$  denotes the number of observations, and  $z$  denotes the  $z$ -statistic associated with the test that the difference between the observed and expected proportion of first-borns is zero.

**Panel A: Birth order**

	Frequency		Proportion		Difference
	Observed	Expected	Observed	Expected	
Birth order: First	79	48	0.534	0.325	0.208
Birth order: Second	30	40	0.210	0.268	-0.058
Birth order: Third	21	25	0.142	0.171	-0.029
Birth order: Fourth	9	15	0.047	0.098	-0.051
Birth order: Fifth	8	8	0.047	0.054	-0.007
Birth order: Sixth or higher	3	12	0.020	0.084	-0.063
Number of observations	148	148			
Goodness of fit: $\chi^2$ ( $p$ -value)	33.05 (0.000)				

**Panel B: First-borns by gender**

	$N$	Proportion First-born			$z$
		Observed	Expected	Difference	
First-born CEOs	148	0.534	0.325	0.208	5.413
First-born Female CEOs	32	0.531	0.325	0.206	2.487
First-born Male CEOs	116	0.534	0.325	0.209	4.809

**Table A3. Inference using Swedish males (Black et al. (2017))**

This table shows the inference using data from Swedish Males from Black et al. (2017). The sample includes 727,111 males, of which 3,917 are CEOs (top managers).

	First child	Second child	Third child	Fourth child	Fifth child	Sum	Reference
Fraction of CEOs (“top managers”)	0.007	0.005	0.004	0.003	0.002		Table 2: Cols 2 - 6
Population	267,923	271,373	132,665	44,108	11,042	727,111	Table 2: Cols 2 - 6
CEOs	1,875	1,357	531	132	22	3,917	calculated
Proportion of CEOs that are first-born							
Observed	0.4788	0.3464	0.1355	0.0338	0.0056	1.0000	
Expected	0.3685	0.3732	0.1825	0.0607	0.0152	1.0000	
Difference in fraction of CEOs relative to first child							
Population numbers	-	-0.0020	-0.0030	-0.0040	-0.0050		Fraction of CEOs above
Regression based, controlling for family fixed effects	-	-0.0017	-0.0020	-0.0018	-0.0026		Table 4: Col 3
Adjusted observed fraction of CEOs	0.0065	0.0048	0.0045	0.0047	0.0039		
Observed CEOs (adjusted)	1,751	1,312	602	209	43	3,917	
Observed proportion first-born (adjusted)	0.4470	0.3350	0.1536	0.0533	0.0111	1.0000	

