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Abstract

Many careers find within-family career following common including law, politics, business, agriculture, medicine, entertainment, and professional sports. As children enter the same career as their parents, there are potential benefits: physical-capital transfer, human-capital transfer, brand-name-loyalty transfer, and/or nepotism. In Formula One (auto racing) career following is also common where many sons follow their father into racing and many brothers race at the same time. Using a panel describing the annual statistics for drivers from 1953-2011, we find that the brothers of Formula One drivers appear to benefit from human capital transfer and nepotism but that sons gain little from human capital transfer and do not enjoy nepotism. We do find, however, that only the best drivers have sons who follow them into racing suggesting that sons can extend the brand name-loyalty their famous fathers have created.

Key words: Motorsports, Nepotism, Human Capital, Brand Loyalty.

JEL Classifications: L83, Z20

1. Introduction

The relationship between a parent's career and a child's career choice has been the interest of researchers across several fields. In economics, Laband and Lentz have studied career following by children in a variety of industries. Not surprising, the reasons for why a child follows a parent into a particular career differ by industry. For example, Laband and Lentz (1983b) show that the children of farmers who also become farmers tend to farm the same land as their parents suggesting both human capital transfer, in the form of knowledge of how to farm, and physical capital transfer, in the form of the land and equipment required to farm. In the United States nearly fifty percent of self-employed proprietors are second-generation business owners, that is, one or more parents were also business owners, suggesting that name brand loyalty, human-capital transfer, and/or physical-capital transfer might all influence the choice of the child. Laband and Lentz (1990a) show that a baseball player who is the son of a former player tends to play the same position as their fathers, suggesting human capital transfer either in the form of natural ability or in the knowledge of how to train and play at the highest level.

Laband and Lentz (1985) show that the children of politicians are more likely than the children of non-politicians to become politicians themselves. Furthermore, the children of politicians do better than their parents in winning elections. The evidence suggests that politics is characterized by brand name loyalty and human-capital transfer in that parent politicians teach their children how to also be successful politicians.

Laband and Lentz (1992) show that the children of lawyers who follow their parents into law tend to do better in the early years of law practice than the children of non-lawyers. The evidence suggests that the practice of law is characterized by human capital transfer in that parents teach their children how to be a successful lawyer. There might also be physical-capital transfer, however, if parents hand a successful practice to a child; but also, perhaps, nepotism if the children of lawyers gain an advantage in where they are accepted to law school or provided with opportunities they receive after law school. Nepotism appears to be a bigger issue in medical school admissions in the United States. Laband and Lentz (1990b) show that the children of doctors have an advantage in medical school admission even if they have lower test scores or grades.

The question asked in this paper is whether there are benefits to family connections in Formula One (henceforth F1) racing. The primary motivation for our interest is that family connections are very common in many areas of auto racing. For instance, in NASCAR in 2005, 23 out of 76 drivers had a family connection. Groothuis and Groothuis (2008) find that there is no nepotism in NASCAR when it comes to career length because sons have no longer careers when controlling for their performance on the track but they do find that a father's have a higher likelihood of exit. They suggest that fathers of drivers may leave early with their son being able to extend their brand name loyalty. In addition, Rotthoff, Depken, and Groothuis (2014) find that when tracking time on camera during NASCAR races, sons of former racers are more likely to be on camera then their performance would indicate. They suggest that the extra time on camera is due to brand loyalty transfer. In F1 racing twelve sons have followed their fathers in that circuit as well as many brothers who raced at the same time. There are many reasons why a child would follow a parent or a sibling into racing including the aforementioned physical-capital transfer, human-capital transfer, brand-name-loyalty transfer, and nepotism.[1] Given that all of the career following F1 to date has been male will use the designation of father, son, and brother.

[1] Historically, male participants have dominated motorsports. However, there are female drivers in NASCAR, NHRA, Formula 3, ARCA, and rally circuits. Ashley Force Hood and Courtney Force, daughters of legendary drag racer John Force, both compete in NHRA events.

Using a panel of annual statistics for F1 drivers from 1950-2011, we investigate whether sons and brothers start their careers earlier and are better early in their career (human capital transfer), whether fathers are better drivers with longer careers than non-father drivers (brand name loyalty), and whether sons and brothers have longer careers than their productivity would suggest (nepotism). To preview our results, it appears that F1 is characterized by a weak form of human capital transfer, with the potential for brand name loyalty transfer between fathers to sons, and that brothers (but not sons) may experience nepotism.

2. Family connections in Formula One Racing: Testable Hypotheses

2.1 Human-Capital Transfer

Formal education is one common way to acquire general human capital. In the United States, a high-school education is expected to provide sufficient knowledge and skills to be successful in college or the work force (Kendall, et al., 2007). However, firm specific human capital is often acquired through on-the-job training in what might be considered a shared investment between the firm and the employee (Becker 1993). Furthermore, many occupational skills are learned informally on the job, such as learning by doing in farming, being a sole proprietor, or learning a corporate culture.

In the area of sport, many of the skills required for success in a particular area fall in between formal and informal education; strategy and tactics might be something that is learned through study and practice whereas innate ability might be augmented with physical training and nutrition. Still other sports skills can only be obtained by participating in the sport through learning by doing. In baseball, hockey, basketball, and soccer, minor league teams develop the talent of players, whereas American football players usually develop their skill for the professional leagues through college athletics. In F1 racing, several lower series, such as Formula 3 series, the GP2 series, and the Formula 3000 series (formerly Formula 2 series), provide avenues through which drivers can develop their skills.

Racing families have an advantage over children in non-racing families in that they grow up in the tradition of racing, have the opportunity to acquire skills and knowledge by being at the track and in the garage with their families, and by having family members who might have plans for intergenerational transfer of brand name loyalty or racing specific capital recourses. For example, although Nico Rosburg was born after his dad's 1982 world championship (Keke Rosburg), as he grew up through the developmental circuit, he had an F1 World Champion in his pits throughout the development process. Laband and Lentz (1983a) suggest that occupation-specific human capital can be acquired as a by-product of growing up around elders with the same occupation-specific human capital, even stating that some human capital is essentially free for career followers.[2] If this type of human-capital spillover is present in F1 racing, we expect to see sons and brothers entering the circuit at a younger age. Furthermore, if human capital transfer is important in F1 racing, drivers with family connections should experience more success early in their careers then drivers without family connections.

This leads to two testable hypotheses:

H1: F1 drivers who are sons of drivers or are brothers of drivers are no younger than other drivers at their debut;

H2: F1 drivers who are sons of drivers or are brothers of drivers have no more success early in their careers than other drivers.

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[2] For a formal model of human capital transfer between generations see Laband and Lentz (1983a). In their model the develop conditions when children acquire their education at home and when they acquire their education formally at school. Our hypothesis is that in Formula One Racing many skills can be transferred informally from fathers to sons.

2.2 Brand Name Loyalty

In F1 racing, sponsorship contracts are tightly held and not publicly available but it is speculated that sponsorship revenue often comprises more than 50% of a particular team's income with the remainder coming from race prize money and shares in media revenues (Tierney and Fairlamb, 2002). Thus, team owners seek increasing sponsor dollars to provide the financial capital to run the team. Corporations sponsor cars and drivers to provide advertisements for their products and exposure of their corporate names. Drivers in many ways become the spokesperson of the corporations that sponsor the team. Thus, the driver's last name becomes associated with a corporation and even a brand on its own; for instance, the 2008, 2014, and 2015 F1 World Campion, Lewis Hamilton, is known for his connection with the Mercedes AMG Petronas team (and likewise these sponsors).

Laband and Lentz (1985) contend that occupational following may be an efficient mechanism for the transfer of rents across generations when the family name embodies goodwill. They argue that this occurs in politics with family members running on the family name such as Kennedy, Clinton, or Bush in the United States and Kinnock or Benn in the United Kingdom. If a family name provides a marketing advantage, then firm owners may choose family-connected workers of lower ability because of fan, consumer, or sponsor preference rather than their own preference. In some ways, brand name loyalty follows Becker's model of customer-based discrimination where owners hire less productive drivers to please sponsors. It appeals to sponsors because fan loyalty to a family name leads to more sales even if the driver is not as productive as other drivers. If family name loyalty is present in F1, we should find that only the most productive drivers have sons follow them into racing as these fathers have developed the greatest potential rents from their family name. This leads to our third testable hypothesis:

H3: F1 drivers who have sons who become drivers are no more productive than drivers who do not have sons who become drivers.

2.3 Nepotism

Intuitively, nepotism is a form of Becker's employer-based discrimination (Becker 1962). In Becker's original model, firm owners get a disutility in hiring members of a particular group. Nepotism, on the other hand, is the result of a firm owner gaining positive utility from hiring family-connected workers. Fathers might gain positive utility from hiring their child even if there are more productive workers available; hence, the popularity of the "and sons" (and increasingly of "and daughters") in firm names. In the area of motorsports, nepotism would manifest with sons of drivers having longer careers than their productivity would otherwise suggest. This leads to our fourth testable hypothesis:

H4: F1 drivers who are sons of drivers or brothers of drivers have careers no longer than non-family connected drivers, all else equal.

In the end, there are many potential reasons for children to follow a parent into a career in motorsports. These reasons, however, are not necessarily mutually exclusive. Human-capital transfer contends that family-connected drivers enter racing at a younger age and might be more productive in the early years of their career. Brand name loyalty states suggests that only the best drivers should have sons who follow them into racing. Finally, nepotism argues that family-connected drivers should have longer careers than their productivity indicates relative to drivers without family connections. The next section describes the data we use to test these various hypotheses in F1 racing.

3. The Data

To test the aforementioned hypotheses, we use a panel describing all individuals who drove in the F1 championship series from 1950 through 2011. This sixty-year panel consists of 728 drivers and 2693 observations. We identified family connections using various data sources that indicate those drivers who are father-son relatives and who are brother-brother relatives. Some drivers are brothers without being sons of another driver and some drivers are the father of another professional driver who did not compete in the F1 circuit. Table 1 reports those drivers identified as fathers, sons, and brothers in the F1 circuit.

[Table 1]

Table 2 provides cross-tabulations of the brothers and sons, fathers and sons, and fathers and brothers. As can be seen, there are ten drivers who are both sons and brothers, for example, Michael and Mario Andretti, and fifty-three drivers who are brothers but not sons of an F1 driver. Five drivers are both the father and a son of another professional driver and sixteen fathers are also a brother of another professional driver.

[Table 2]

Table 3 reports the descriptive statistics of the entire sample and for each category of family connection. The data include age as well as performance data such as wins, podiums, laps led, races, and average finish. The average number of races per driver is about 7, per season wins 0.31, podium finishes, the number of times the driver finished a race in the top three, averages .94, and laps led per season averages 20.74. The average age in F1 is 31 with the youngest driver being 19 and the oldest 56.

[Table 3]

In Table 3, we also report the means by family connection, comparing those with family connections to those with no family connections. We find that all performance variables are better in the various sub-categories of family connections compared to drivers without family connections. On average fathers tend to do better than sons, while brothers do better than sons but worse than fathers. The average career length, as measured by all non-right censored observations ranges from 3.70 years for drivers without family connections to 6.24 years for fathers. The careers of sons average 4.35 years and those of brothers last 6.20 years. Sons and brothers start their careers at the average age of 27 whereas fathers start at an average age of 28 and drivers without family connections start their career at an average age of 31.

On the surface, the averages are consistent with nepotism, brand transfer, or human-capital transfer and all might cause career following in the F1 circuit. To further explore the importance of family relations and determine if nepotism exists in F1, we analyze the data using parametric, non-parametric, and semi-parametric techniques.

4. Human Capital Transfer and Brand Loyalty

Sons of drivers and brothers of drivers might have inherent advantages because they grow up in and around the racing environment. The human capital transfer from fathers to sons and from brother to brother might lead to sons and brothers to be better drivers at earlier ages, thereby increasing the odds that these individuals would be hired to drive for an F1 team at an earlier age than non-family-tied drivers. To test this hypothesis, we test whether there is a statistically significant difference in starting age between sons and non-sons and brothers and non-brothers. The results of these tests are reported in Table 4a and show that both sons and brothers start their career in F1 at younger ages than non-sons and non-brothers. Sons start driving, on average, when they are 28.6 years of age whereas non-sons average 31.47 years of age when they start driving. Brothers start driving, on average, when they are 30.33 years of age whereas non-brothers average 31.53 years of age when they start driving. Both differences are statistically significant at the five percent level and suggest that there might be human capital transfer within F1 racing.

A second hypothesis about human capital transfer is that sons and brothers might perform better early in their career. To test this, we compare four common productivity measures between sons and non-sons and brothers and non-brothers after three years of racing in the F1 circuit: total races completed, total wins, total podiums, and total laps led. The results are reported in Table 4a. While both sons and brothers complete more races than non-sons and non-brothers, respectively, in their first three years, sons do not have more wins, podiums, or laps led than non-sons after three years. However, brothers do have more wins, podiums, and laps led than non-brothers after three years of racing. In the case of sons, we find no evidence that the four performance measures are jointly statistically different from non-son drivers. However, for brothers we do find evidence that their production statistics are jointly statistically different from non-brother drivers. Therefore, while both sons and brothers exhibit human capital transfer by starting their careers earlier and having a few more races after three years, it appears that brothers enjoy more productivity benefits from human capital transfer than sons.

[Table 4]

A third hypothesis about family connections in F1 is that fathers who have sons in racing are themselves among the best drivers. This allows the driver fathers to capitalize on their brand (family) name through future generations of drivers. If a driver does not have any brand loyalty because they are not very good drivers, this would provide less incentive to hire or encourage the next generation to enter the circuit. We aggregate each driver's career across all years and test whether fathers are statistically better than drivers without family connections in seven categories: age at end of career, total races, total laps, average finishing position, total wins, total podiums, and total laps led. The results for these tests are reported in Table 4b.

Fathers of drivers end their careers at an average age of 35.9 whereas non-fathers (who are also non-sons and non-brothers) end their career at an average age of 32.9 (the difference is statistically significant at the five percent level). Fathers also complete more races than their peers (40 more on average), have more laps completed (1967 more on average), and have a better finishing position (1.69 positions better on average) over the course of their careers. While having longer careers (3.67 years longer on average) can contribute to more races and laps completed, fathers are also better drivers as reflected in more wins (4.5 more on average), more podiums (10.2 more on average), and more laps led (289 more on average) during their career. We find that for fathers these productivity statistics are jointly statistically different from zero. This is consistent with brand name recognition having value in F1 as it does in other areas.

Table 4b also reports the conditions for brand name loyalty for sons and brothers at the end of their career. The evidence suggests that sons do not have jointly significantly different productivity statistics at the end of their careers compared to non-son drivers. On the other hand, brothers do have jointly significantly different and greater production statistics at the end of their career compared to non-brother drivers. This suggests that not only do brothers receive more human capital transfer compared to sons but brothers also end their careers with greater potential brand name loyalty, which they could pass along to the next generation of drivers.

5. Nepotism in Formula One: Evidence from Career Duration

The possibility of nepotism in F1 racing is the final hypothesis to test. We define nepotism as occurring when drivers who are sons or brothers have longer careers holding their production constant with non-son and non-brother drivers. We could estimate career lengths using standard OLS techniques, but doing so has well-known problems. Therefore, we analyze the career lengths of F1 drivers via non-parametric and semi-parametric methods.

5.1 Non-parametric Estimation

To help understand career duration in F1 racing, we calculate yearly hazard rates as:

(1) $h_t = d_t / n_t$,

where d_t is the number of drivers who end their career in year t and n_t is the number of drivers at risk of ending their career in year *t*. The hazard rate can be interpreted as the percentage of drivers who exited F1, given they have acquired some level of tenure at time *t*. We suspect that the majority of exit is involuntary, particularly for drivers with short careers, although our data do not indicate whether exit is voluntary or not.

In Table 5, we report the total hazard rate and the hazard rate for drivers with no family connections and those with family connections by being a father, son, or brother. We find that family-connected drivers are less likely to exit early in their F1 career than non-family connected drivers. It is also clear that drivers who become fathers of drivers have the lowest probability of exit. Brothers who race also have a lower probability of exit. Sons have a higher probability of exit than both brothers and fathers but a lower probability of exit than drivers without family connections.

[Table 5]

In Figure 1, we plot the hazard rate by family-connection category. The plot of drivers without family connections shows that the hazard rate gradually declines for the first four years of the average driver's career and then levels out. Yet, it is always higher than for family-connected drivers except in the last few years for sons. Sons also show a gradual decline in career exit during the first four years of their career before their exit probability levels off. Brothers and fathers exhibit relatively low and steady exit probabilities with some jumps around seven years of experience.

Comparing the plots, it appears that drivers with family connections are somewhat less likely to exit F1 during the first ten years of their career as their hazard rates are consistently lower than those of drivers without family connections. After ten years, however, both the brother and son hazard rates and the hazard rates of drivers without family connections cross while the hazard rates of fathers always remain lower than the hazard rate of drivers without family connections. While the non-parametric approach suggests there are differences in career length between family-connected and non-family-connected drivers it is not possible with this methodology to determine if these differences are due to productivity differences or nepotism. We therefore move to semi-parametric techniques to control for differences in productivity.

5.2 Semi-parametric Estimation

Methodology

To capture the overall length of a driver's career, our data contains only flow samples because 1950 was the first year of the series. As with most panels, our data is right-censored where many careers were ongoing when our sample ended in 2011. We estimate semi-parametric hazard functions following Berger and Black (1999), Groothuis and Hill (2004), and Groothuis and Groothuis (2008). Because our data are at the season level, we calculate our hazard model as a discrete random variable. As with Groothuis and Hill (2004), we model the durations of a single spell.

We also assume a homogeneous environment so that the length of the spell is uncorrelated with the calendar time in which the spell begins, except for a time trend variable. This assumption lets us treat all a driver's tenure of a given length of time as the same regardless of when it occurred in the sample period. For instance, all fourth-year drivers are assumed to have the same base-line hazard, regardless of calendar time. This implies that a fourth-year driver in 1960 has the same baseline hazard as a fourth-year driver 2010, with the exception of a time trend (for the technical details of the model see Groothuis and Hill 2004.)

Given this model, the hazard function is the conditional probability of exiting F1 series, given that the F1 career lasted until the previous season. The hazard function must have a range from zero to one; in principle, any mapping with a range from zero to one will work. Cox (1972) recommends

$$(2) \qquad \frac{h(t,x,\beta)}{1-h(t,x,\beta)} = \frac{h_t}{1-h_t} e^{x\beta} = \exp(\gamma_t + x\beta) \,,$$

which is simply a logit model with intercepts that differ by time periods. The term h_t is a baseline hazard function, which is common to all observations; the $x\beta$ term, determined by the driver's personal and productivity characteristics, shifts the baseline hazard function, but it affects the baseline hazard function in exactly the same way each period. Berger and Black (1999) consider other hazard functions and find that the results are relatively robust across various specifications of the hazard function. We follow Cox and use the logit model.

The intuition behind equation (2), when using the logit model for the hazard function, is relatively simple. For each year during the sample period in which a driver races in F1, the driver either comes back for another season or ends his career. If the driver's career ends, the dependent variable takes on a value of one; otherwise, the dependent variable is zero. The driver remains in the panel until either the driver exits F1 or the panel ends. If the panel ends, the worker's spell is considered right-hand censored. Thus, a driver who begins his F1 career during the panel and races for 6 years will enter the sample six times. The value of his dependent variable will be zero for the first 5 years (tenure year one through year five) and be equal to one for the sixth year.

Because the drivers in the panel have varying career lengths we are able to identify the hazard function for both long and short careers. The disadvantage to this approach is that the vector γ_t in equation (2) can be very large. Here it would require 19 dummy variables. We also run into problems with the Cox technique because in F1 there are too few drivers who have very long careers, thereby making it difficult to precisely estimate the dummy variables in γ_t that reflect the longest careers. To simplify the computation of the likelihood function and keep the few observations for long careers, we approximate the γ_t vector with a 5th order polynomial in driver's tenure. This reduces the number of parameters to be estimated from 19 to five. The hazard function becomes

(3) $$\frac{h(t,x,\beta)}{1-h(t,x,\beta)} = \Phi(t)\, e^{x\beta} = \exp(\phi(t) + x\beta)\ ,$$

where $\phi(t)$ is a 5th order polynomial in the driver's tenure. Once again, we choose the Taylor series approximation technique over using tenure dummies, due to the small number of observations for high tenures. This method provides a very flexible specification of the baseline hazard, but does impose more restrictions than Cox's model.[3]

Estimation Results

In Table 6 we report the estimates for two specifications of equation 2. In Model (1), reported in Column 1, we include only the dummy variables for family connections and continuous or nearly continuous positive performance measures; column 2 reports the marginal effects evaluated at the sample means (or discrete changes for indicator variables). In Model (2), reported in Column 3, we include the family dummy variables and negative performance measures; Column 4 reports the marginal effects evaluated at the sample means (or discrete changes for indicator variables).

[Table 6]

In the first specification, we find that performance measures influence the likelihood of racing the next season. The more podiums, races completed, and laps completed in a season the less likely is a driver of leaving F1 racing. Furthermore, the better the average finish of the driver during the season the less likely they are to leave F1 racing that year. It appears that number of races won and laps led over the season are not significant influences on drivers leaving in a given year. Not surprising, the age of the driver is positively correlated with leaving F1 racing. Interestingly, the current year is also positively correlated with exit suggesting that recent drivers are more likely to exit F1 racing in a given year, all else equal, than drivers in the past. This finding might suggest a greater level of competition among drivers who seek to drive in F1 in recent years than in the past.

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[3] When higher order polynomials (the sixth and seventh power) are included, the results do not change. This suggests that a fifth order polynomial is flexible enough to capture the influence of the base line hazard.

The coefficients on family connections provide some interesting results. To allow for ease of interpretation, we convert the coefficient into a percentage and focus on the magnitude of the effect by using 100[exp(β) -1]. This conversion gives us the percentage difference in hazard rates between the differing family connections. Looking at Model (2), we find that fathers are 33.5 percent less likely to exit in a given year, holding other factors constant; being a son does not impact career exit in a statistically significant fashion; and being a brother lowers the likelihood of exit by approximately 19 percent. These results suggest that there might be some nepotism in F1 directed toward brothers (rather than sons); brothers have longer careers than non-brothers after controlling for their quality as drivers.

Model (3) replaces the positive productivity measures of wins, podiums, laps led, total laps completed, and average finishing position, with negative productivity measures: indicator variables for never leading a lap during the season, never winning during the season, and never having a podium during the season. In this case, the results suggest that never leading a lap and never having a podium both contribute to increased probability of exiting F1 in a given year (7.35 percent and 11.74 percent, respectively). We also find that fathers and brothers are still less likely to exit F1 in a given year, all else equal, and that sons do not seem to experience any different career length.

Overall, the evidence suggests that fathers have longer careers than non-fathers (who are also non-sons and non-brothers) perhaps in an attempt to continue to grow their brand name recognition, which will be more valuable when their son eventually enters professional racing, most often years after the father has retired. In terms of nepotism, which we define as extending the career of a family member beyond what their productivity would suggest, only brothers seem to enjoy any impact of nepotism on their career length; sons do not experience any longer careers than drivers who are not sons (or fathers or brothers).

6. Conclusions

This paper has undertaken an investigation to the impact of family connections in F1 racing. Family connections have proven important in other industries, including law, acting, and sports (including other forms of motorsports). Children might follow their parents into a particular career because of human capital transfer between parents and children, brand-name recognition, and nepotism. We test all three of these possibilities in F1 using data describing drivers in that circuit from 1950 through 2011.

We find evidence that sons of drivers and brothers of drivers both enter the circuit at a lower age but only brothers seem to be more productive early in their careers. Sons of drivers are no better than non-son drivers in wins, podiums, or laps led during the first three years of their career; drivers who are brothers of other drivers are better than non-brother drivers in all of these categories. This suggests that while both sons and brothers might gain human capital transfer, it appears brothers gain more.

We test whether fathers are better drivers than drivers who do not have a child follow them into professional racing. We find that fathers tend to end their careers at an older age than non-fathers, and that fathers are better than non-fathers in terms of total wins, total podiums, total laps led, and average finishing position. This suggests that those drivers who have a son follow them into racing are from the best drivers. This supports the idea that fathers build brand-name recognition, which is transferred to their children.

Finally, we test whether career length (as measured in the years between a driver's debut and the driver's exit from F1 racing) is impacted by productivity measures and family connections. We find that, holding productivity measures constant, drivers who become fathers of future professional racers are less likely to exit F1 in a given year, supporting the previous intuition that such drivers seek to build brand-name recognition. Being the son of a driver does not influence the odds of exiting in a given year, suggesting that there is no nepotism for sons. On the other hand, being a brother of a driver reduces the odds of exit by approximately six percent, holding productivity constant. Thus, there appears to be nepotism directed toward brothers – their careers are longer than their productivity measures suggest. Therefore, it appears that family connections are important for certain drivers in F1 as they are in other industries.

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Table 1: Family Connections in Formula One (1950-2011)

FATHERS				SONS		BROTHERS			
First	Last	First	Last	First	Last	First	Last	First	Last
Mario	Andretti	Niki	Lauda	Cliff	Allison	Michele	Alboreto	Tim	Mayer
Michael	Andretti	Jan	Magnussen	Michael	Andretti	Cliff	Allison	Stirling	Moss
Julian	Bailey	Nigel	Mansell	Alberto	Ascari	Mario	Andretti	Kazuki	Nakajima
Edgar	Barth	Satoru	Nakajima	Sebastien	Bourdais	Michael	Andretti	Larry	Perkins
Derek	Bell	Jonathan	Palmer	David	Brabham	Jean	Behra	Nelson	Piquet Jr.
Tony	Bettenhausen	Olivier	Panis	Jenson	Button	Stefan	Bellof	Didier	Pironi
David	Brabham	Roger	Penske	Colin	Davis	Lucien	Bianchi	Kimi	Raikkonen
Jack	Brabham	Paul	Pietsch	Christian	Fittipaldi	David	Brabham	Dick	Rathman
Martin	Brundle	Andre	Pilette	Gregor	Foitek	Ernesto	Brambilla	Jim	Rathmann
Ronnie	Bucknum	Nelson	Piquet	Gene	Hartley	Vittorio	Brambilla	Peter	Revson
Adrian	Campos	Alain	Prost	Alan	Jones	Martin	Brundle	Pedro	Rodriguez
Duane	Carter	Bobby	Rahal	Pierluigi	Martini	Eddie	Cheever Jr.	Ricardo	Rodriguez
Erik	Comas	Keke	Rosberg	Stirling	Moss	Patrick	DePailler	Troy	Ruttman
Derek	Daly	Louis	Rosier	Kazuki	Nakajima	Jose	Dolhem	Ian	Scheckter
Emilio	de Villota	Paul	Russo	Tim	Parnell	Corrado	Fabi	Jody	Scheckter
Jean-Denis	Deletraz	Bob	Said	Andre	Pilette	Teo	Fabi	Harry	Schell
Mark	Donohue	Ian	Scheckter	Teddy	Pilette	Luigi	Fagioli	Michael	Schumacher
Guy	Edwards	Jody	Scheckter	Nelson	Piquet Jr.	Ralph	Firman	Ralf	Schumacher
Teo	Fabi	Michael	Schumacher	Nico	Rosberg	Emerson	Fittipaldi	Jackie	Stewart
Juan Manuel	Fangio	Jo	Siffert	Harry	Schell	Wilson	Fittipaldi	Jimmy	Stewart
Wilson	Fittipaldi	Jackie	Stewart	Mike	Taylor	Marc	Gene	Maurice	Trintignant
Elmer	George	John	Surtees	Michael	Thackwell	Roberto	Guerrero	Bobby	Unser
Dan	Gurney	Piero	Taruffi	Bobby	Unser	Hubert	Hahne	Jerry	Unser
Jim	Hall	Bobby	Unser	Rikky	von Opel	Lewis	Hamilton	Gijs	van Lennep
Graham	Hill	Jerry	Unser	Markus	Winkelhock	Nick	Heidfeld	Gilles	Villeneuve
Kazuyoshi	Hoshino	Jos	Verstappen	Alexander	Wurz	Damon	Hill	Jacques	Villeneuve
James	Hunt	Gilles	Villeneuve			James	Hunt	Luigi	Villoresi
Jacky	Ickx	Bill	Vukovich			Alan	Jones	Derek	Warwick
Alan	Jones	Manfred	Winkelhock			Jan	Lammers	Graham	Whitehead
Jacques	Laffite					Chico	Landi	Peter	Whitehead
						Nicola	Larini	Justin	Wilson
						Pierluigi	Martini	Manfred	Winkelhock

Table 2: Cross Tabulations of Family connections

	BROTHERS		
SONS	NO	YES	TOTAL
NO	655	53	708
YES	16	10	26
TOTAL	671	63	734

	FATHERS		
SONS	NO	YES	TOTAL
NO	654	54	708
YES	21	5	26
TOTAL	675	59	734

	FATHERS		
BROTHERS	NO	YES	TOTAL
NO	628	43	671
YES	47	16	63
TOTAL	675	59	734

Table 3: Descriptive Statistics

	Total Sample	No Family	Father	Son	Brother
Exit	.27 (.45)	.31 (.46)	.14 (.35)	.04 (.42)	.14 (.37)
Age	31.41 (6.10)	31.40 (6.13)	32.90 (6.04)	28.58 (4.99)	30.34 (5.75)
Tenure	3.95 (3.28)	3.51 (2.97)	5.55 (3.94)	4.17 (2.98)	5.02 (3.47)
Races	7.10 (6.30)	6.27 (6.17)	9.43 (5.81)	8.85 (6.55)	9.83 (6.15)
Wins	.31 (1.11)	.16 (.75)	.95 (1.95)	.46 (1.24)	.74 (1.84)
Podiums	.94 (2.24)	.64 (1.81)	2.07 (3.22)	1.02 (2.29)	1.81 (3.11)
Laps Led	20.74 (70.19)	11.87 (51.58)	59.21 (118.41)	30.18 (75.61)	45.15 (106.96)
Laps Completed	340.08 (306.47)	298.55 (293.68)	453.41 (295.88)	432.10 (339.27)	472.03 (319.98)
Average Finish	5.53 (5.39)	4.93 (5.29)	7.46 (5.50)	6.73 (5.31)	7.12 (5.03)
Never Led	.78 (.41)	.83 (.37)	.61 (.49)	.69 (.46)	.65 (.48)
Never Won	.88 (.32)	.92 .27)	.69 (.46)	.84 (.37)	.77 (.42)
Never Podium	.74 (.73)	.79 (.40)	.54 (.50)	.71 (.46)	.56 (.50)
Sample Size	2,733	1,988	405	113	392
Notes: Standard deviations reported in parentheses.					

Table 4a: Human Capital Transfer to Sons and Brothers

Human Capital Transfer	Sons	Brothers
H1: Age at Debut	-2.86*** (4.92)	-1.19*** (3.62)
H2: Productivity in First Three Years		
Average Finishing Position	-1.41 (1.17)	-1.12** (0.66)
Total Wins	0.31 (0.38)	0.95*** (0.21)
Total Podiums	-0.41 (.1.01)	2.79*** (0.55)
Total Laps Led	8.08 (0.25)	54.58 (0.14)
Joint Test of Significance ($F_{4,1336}$)	1.92	7.60***
Notes: Sample describes productivity for 336 Formula One drivers who had a career at least three years long. Differences reported between sons/brothers against non-sons/non-brothers. Absolute values of t-statistics reported in parentheses. *** p<0.05, ** p<0.10.		

Table 4b: Conditions for Brand Name Loyalty at End of Career

Productivity Measure	Fathers vs. Non-Father Peers	Sons vs. Non-Son Peers	Brothers vs. Non-Brother Peers
Average Finishing Position	-1.69*** (2.17)	0.41 (0.32)	-2.18*** (2.79)
Age at Career End	2.95*** (2.83)	-4.68*** (2.77)	0.02 (0.02)
Total Races	40.44*** (5.99)	14.19 (1.34)	35.14*** (5.22)
Total Laps	1967.89*** (6.11)	852.52* (1.68)	1732.55*** (5.38)
Total Wins	4.58*** (7.47)	1.13 (1.49)	2.10*** (4.21)
Total Podiums	10.25*** (6.59)	2.32 (1.07)	6.87*** (4.89)
Total Laps Led	289.60*** (7.21)	687.75 (1.31)	1155.33*** (3.42)
Test for Joint Significance ($F_{7,5124}$)	13.32***	2.30***	7.73***
Notes: Absolute value of t-statistics reported in parentheses. *** p<0.05, ** p<0.10.			

Table 5: Career Exit Hazard Rates

Tenure	No Family connections	Father	Son	Brother
1	.379	.100	.269	.143
2	.363	.122	.289	.154
3	.309	.133	.250	.111
4	.244	.105	.125	.091
5	.253	.107	.095	.162
6	.277	.135	.211	.148
7	.235	.138	.200	.102
8	.279	.125	.083	.150
9	.310	.139	.182	.222
10	.250	.162	.222	.229
11	.255	.161	.429	.333
12	.286	.115	.750	.444
Max Tenure	19 years	18 years	12 years	18 years

Table 6: Determinants of Career End

VARIABLES	(1) Exit (1=Yes)	(2) dPr(Exit)/dX	(3) Exit (1=Yes)	(4) dPr(Exit)/dX
FATHER	-0.408***	-0.111***	-0.401***	-0.108***
	(0.084)	(0.020)	(0.085)	(0.020)
SON	0.122	0.039	0.127	0.040
	(0.123)	(0.040)	(0.130)	(0.043)
BROTHER	-0.210**	-0.060**	-0.193**	-0.055**
	(0.087)	(0.023)	(0.088)	(0.024)
YEAR	0.025***	0.008***	0.024***	0.007***
	(0.003)	(0.001)	(0.003)	(0.001)
AGE	0.046***	0.014***	0.045***	0.014***
	(0.005)	(0.002)	(0.005)	(0.002)
RACES	-0.085***	-0.026***	-0.084***	-0.025***
	(0.017)	(0.005)	(0.008)	(0.002)
WIN	0.191*	0.058*		
	(0.113)	(0.034)		
PODIUM	-0.094**	-0.029**		
	(0.037)	(0.011)		
LAPSLED	-0.162	-0.049		
	(0.159)	(0.048)		
LAPS	-0.007	-0.002		
	(0.036)	(0.011)		
AVE FINISH	0.013**	0.004**		
	(0.005)	(0.002)		
NEVERLED			0.246**	0.071**
			(0.111)	(0.030)
NEVERWIN			-0.163	-0.052
			(0.150)	(0.049)
NEVERPODIUM			0.392***	0.111***
			(0.104)	(0.027)
CONSTANT	-51.740***		-49.797***	
	(5.178)		(5.248)	
Observed Probability	0.267		0.267	
Predicted Probability	0.231		0.229	

All models include 2,693 observations for F1 drivers from 1950-2011. Robust standard errors clustered by driver reported in parentheses. Marginal effects evaluated at the sample means for continuous variables; evaluated using discrete changes for indicator variables. Predicted probability evaluated at sample means. *** p<0.01, ** p<0.05, * p<0.1. Each model includes a fifth order polynomial in driver tenure (in years) and is jointly significant at the 99% level.

Figures

Figure 1: Career Exit Probability by Driver Family connections