Gender Differences in Executive Compensation and Job Mobility

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Fewer women than men become executive managers. They earn less over their careers, hold more junior positions, and exit the occupation at a faster rate. We compiled a large panel data set on executives and formed a career hierarchy to analyze mobility and compensation. We find, controlling for executive rank and background, that women earn higher compensation than men, experience more income uncertainty, and are promoted more quickly. Among survivors, being female increases the chance of becoming chief executive officer. The unconditional gender pay gap and job-rank differences are primarily attributable to female executives exiting the occupation at higher rates than men.

I. Introduction

This article studies gender differences in mobility and compensation among top executives on the basis of a large matched panel data set on

For comments and suggestions, we thank Christopher Taber, Kenneth Wolpin, seminar participants at Washington and Stanford Universities, and conference attendees at the Society of Labor Economists 2007 and the 2008 World Congress on National Accounts and Economic Performance Measures for Nations. This research is supported by the Center for Organizational Learning, Innovation, and Performance in Carnegie Mellon University and National Science Foundation grant SES0721098. Contact the corresponding author, George-Levi Gayle, at glgayle@me.com.

[*Journal of Labor Economics*, 2012, vol. 30, no. 4]

0734-306X/2012/3004-0004$10.00

executives and their firms. First, we explore the difference in mobility rates and compensation between male and female executives by education and employment history. Then, we develop a dynamic decomposition framework to quantify the effects of gender differences in characteristics upon entering the market for top executives (age, education, rank, and complete labor market history), exit rates from the top-executive occupation, and job transitions throughout their executive careers (both internal rank transitions and transitions that involve firm turnover) on the gender gap in compensation, expected career length, and the probability of becoming a chief executive officer (CEO).

While there is a large literature on gender gaps in the labor market, few studies focus on the gender gap for top executives in publicly traded firms. Four exceptions are Bertrand and Hallock (2001), Bell (2005), Albanesi and Olivetti (2008), and Selody (2010). While we used the same primary data source for compensation as the above mentioned papers, our article differs in three major aspects. First, we match the compensation data with detailed executive-background characteristics, allowing us to account for gender differences in educational attainment and actual labor market experience.[1] Second, we construct a detailed career hierarchy of rank and use it to analyze gender differences in mobility patterns. Third, following the literature on executive compensation (see Antle and Smith 1985, 1986; Hall and Liebman 1998; Margiotta and Miller 2000; Gayle and Miller 2009a, among others), we used a comprehensive measure of total compensation that includes direct compensation plus the changes in wealth from holding firm options and restricted stocks, instead of accounting for direct compensation only.

In order to study gender differences in mobility (i.e., promotions, demotions, and lateral moves), we need to construct a hierarchy of ranks. Our approach builds on the case study of internal promotions within a single firm by Baker, Gibbs, and Holmstrom (1994b), which follows the firm's white-collar workers over a broader span of their life cycle. Our framework, however, covers job transitions within and between firms. In the spirit of Baker et al. (1994b), we adopt two axioms for defining a job hierarchy: that promotions should reflect life cycle job transitions and that employee compensation, and payoff-relevant variables that change over time within a job spell, should not determine rank. We add a third axiom, which every hierarchy should satisfy, called transitivity: no sequence of consecutive promotions should constitute a demotion.[2] Defined this way, a hierarchy is an example of a rational ordering. Our data on

[1] Mincer and Polachek (1974), O'Neill and Polachek (1993), Wellington (1993), and Gayle and Golan (2012) have shown that actual labor market experience accounts for most of the gender wage gap among ordinary workers.

[2] The data in Baker et al. (1994b) automatically satisfy the third axiom without further restrictions.

promotion and turnover are drawn from roughly 2,500 publicly listed firms, 30,000 executives, and 60 job descriptions over a 16-year period. From this large longitudinal data set compiled from observations on executives and their firms, we define and construct a career hierarchy, ranking jobs in the executive market and reporting on their transition matrices.

Only 5% of executive management is female. This fact suggests that female executives may be drawn from a more select population than male executives are. Consequently, their characteristics may differ from those of male executives. Assuming compensation and promotion rates do not vary with gender, female executives being more qualified than male executives could suggest that gender discrimination exists in this market. To address these selection issues, we augmented about half the data on executive promotion, turnover, and compensation with the subjects' professional and demographic background information compiled from the Marquis Who's Who database, which contains details about listees' age, gender, education, work experience, executive experience, and firms that employ them. Our empirical analysis shows that male and female executives have different background characteristics and experience. We find that women are paid more and that their pay is tied more closely to the firm's performance (i.e., they have higher pay for performance than men), conditional on rank, background, and experience. We also find that women are promoted faster internally but display similar rates of external promotion and demotion. Female executives, however, have higher exit rates than men. At both age 39 and age 49, the probability of a female executive becoming CEO is less than half that of male executives.

The decomposition shows that male executives' survival rate is twice that of female executives. We find that the differences in initial rank and in transitions to ranks have almost no effect on the differences in career length, suggesting that these differences are not because women begin in or transition into "dead-end" positions. Instead, most of the gender differences in career length are accounted for by the difference in exit rates. The gender differential of becoming a CEO is explained jointly by the differences in initial rank and exit rates. In fact, conditional on survival as an executive at any age, women have a higher probability of becoming a CEO than do men. We find that the average career compensation as well as overall career compensation are lower for women than men at all ages. As suggested by the regression analysis, the differences are not driven by unequal pay. The exit rate as well as initial assignments are the largest factors driving the differences in average and total career compensation. Overall, our findings suggest that the differential occupational exit rates between the genders create a spurious gap in average lifetime compensation as average compensation rises with rank. While explaining the source of the gender differences in exit rates is beyond the scope of this article, our findings can be explained by women acquiring more nonmarket human capital throughout their lives. Alternative existing theories of gender discrimination can explain the higher exit rates and can be consistent with some of the evidence but have difficulty reconciling other patterns found in the data.

The results on the gender difference within executive management are mixed. Bell (2005), Albanesi and Olivetti (2008), and Selody (2010) find that women are paid less than men at equivalent ranks, contradicting earlier work on this subject by Bertrand and Hallock (2001). With respect to compensation level, our results confirm those of Bertrand and Hallock (2001), while our finding on volatility contradicts findings in Albanesi and Olivetti (2008) and Selody (2010). We find that women have the same pay sensitivity to bad outcomes, but they have higher sensitivity to good firm performance than men have. This contradiction is mainly due to the highly nonlinear nature of the dependence of pay on firm performance and the fact that, as documented in Hall and Liebman (1998) and Gayle and Miller (2009a), most of the variability of compensation comes from changes in wealth from holding firm options and restricted stocks.

Albrecht, Björklund, and Vroman (2003) recently concluded that there is a glass ceiling in Sweden because women are underrepresented in the upper quantiles of the wage distribution. Similarly, Blau and Kahn (2004) concluded from their study of wage data for the United States that the gender gap stopped shrinking 15 years ago and has not closed. Black et al. (2008) report that, although highly educated women earn approximately 30% less than men, more than half, but typically less than all, of the difference is accounted for by background variables such as age, education, and work experience. Their results are corroborated in a study of successive cohorts of master of business administration graduates from the University of Chicago by Bertrand, Goldin, and Katz (2010), who report that gender differences in the wages of young professionals can be largely attributed to differences in college education, career interruptions, and weekly hours worked.

The gender differences in the executive labor market cannot be definitively understood with wage data alone. Men and women are also distinguished by their promotion rates (or more generally job transitions), as well as occupational exit rates. Ginther and Hayes (1999, 2003), McDowell, Singell, and Ziliak (1999), and Ginther and Kahn (2004) compared the trajectories of male and female academic faculty in the social sciences and humanities, finding that women tend be paid less at any given rank and are also less likely to be promoted. Pekkarinen and Vartiainen's (2004) empirical study of metal workers in Finland found that women are internally promoted more slowly than men. By way of contrast, we find that within executive management, women are more likely than men to be promoted conditional on rank, background, and experience. However, our results on the differential exit rate between the genders are consistent with previous results found for academics.

Section II describes our data and variable construction. Section III presents our empirical analysis. Section IV presents our decomposition, and Section V discusses our findings and concludes.

II. Data and Hierarchy Constructions

The main sample for this study consists of data on the 2,818 firms from the December 2006 version of the Standard and Poor's (S&P) ExecuComp database supplemented by the S&P COMPUSTAT North America database and monthly stock price data from the Center for Securities Research database. We also gathered background history for a subsample of 16,300 executives, by matching the 30,614 executives from our COMPUSTAT database for 1991–2006 using their full name, year of birth, and gender with the records in the Marquis Who's Who, which contains biographies of about 350,000 executives.

A. Main Sample

Most of the characteristics of the executives and firms in the main sample require no (further) explanation, but the construction of several variables merits remarks. The sample of firms was initially partitioned into three industrial sectors by Global Industry Classification Standard (GICS) code. Sector 1, called primary, includes firms in energy (GICS 1010), materials (1510), industrials (2010, 2020, 2030), and utilities (5510). Sector 2, consumer goods, consists of firms from consumer discretionary (2510, 2520, 2530, 2540, 2550) and consumer staples (3010, 3020, 3030). Firms in health care (3510, 3520), financial services (4010, 4020, 4030, 4040), information technology, and telecommunication services (410, 4520, 4030, 4040, 5010) comprise sector 3, which we call services. In the main sample, 35% of the firms belong to the primary sector, 27% to consumer goods, and the remaining 38% to the services. Firm size was categorized by total employees and total assets. The sample mean value of total assets is US$(2006)13.3 billion with standard deviation $62 billion, while the sample mean number of employees is 18,930 with standard deviation 52,520.

Top executives are rarely paid like most other professionals, at a rate more or less equalized across a large market for similarly skilled workers after adjusting for cost-of-living and amenity indexes. Executive compensation is tied instead to various indicators of managerial effort, such as the firm's performance. As such, we followed the literature on executive compensation and constructed the widely used measure of firm performance, abnormal returns on stock. Denote the total wage bill of executives in all positions by W_{t+1} and the dividend paid to shareholders by

D_{t+1}. Let e_t denote the equity value of the firm at time t and $\overline{\pi}_{t+1}$ denote the return on the market portfolio. We then define the gross abnormal return to the firm before factoring the aggregate compensation costs as

$$\pi_{t+1} = \frac{e_{t+1} - e_t + D_{t+1}}{e_t} + \frac{W_{t+1}}{e_t} - \overline{\pi}_{t+1}. \tag{1}$$

Abnormal return is then calculated using the formula in equation (1), where the value of equity at the beginning and end of the year and dividends paid during the year are taken from the S&P COMPUSTAT North America database, and the market return is calculated using monthly stock-price data from the Center for Securities Research database.

B. Matched Sample

The matched sample consists of a subsample of 16,300 executives for whom we gathered background history. The matched data give us unprecedented access to detailed firm characteristics, including accounting and financial data, along with managers' characteristics, namely, the main components of their compensation, including pension, salary, bonus, option, and stock grants plus holdings, and their sociodemographic characteristics, including age, gender, education, and a comprehensive description of their career path sequence described by their annual transitions through the 35 possible positions. In the matched sample, 36% of the firms belong to the primary sector (as opposed to 35% for the main sample), 27% to consumer goods (the same as in the main sample), and the remaining 37% to the services sector (as opposed to the 38% in the main sample). Therefore, as far as the sectorial composition of the sample is concerned, the two samples are almost identical. The matched sample mean value of total assets is US$(2006)13.8 billion with standard deviation $63.2 billion, while the matched sample mean number of employees is 19,600 with standard deviation 54,000. The firms in the matched sample are slightly larger than the firms in the main sample on both measures of firm size.

C. Hierarchy Construction

The question of gender differences in mobility presupposes a hierarchy of ranks. The approach we take to constructing such a hierarchy builds on the personnel economics literature (see Baker, Gibbs, and Holmstrom 1994a; Gibbons and Waldman 1999; Barmby et al. 2001). Typically the purpose of the hierarchy is to study the relationship between job mobility and compensation; in order to do that, the hierarchy is constructed independent of compensation. Here, we follow the approach in Baker et al. (1994a) of building a hierarchy on the basis of executives' transitions across different jobs; we formalize the approach and generalize it to multiple firms. Because the hierarchy is constructed using patterns of transitions across different job titles, it captures career paths and life cycle transitions. The data we use to construct a career hierarchy were compiled from annual records on 30,614 individual executives, taken from the S&P ExecuComp database, itemizing their compensation and describing their title. Each executive worked for one of the 2,818 firms comprising the (composite) S&P 500, Midcap, and Smallcap indexes for at least 1 year spanning 1991–2006, which covers about 85% of the US equities market. In the years for which we have observations, the executive was one of up to the top-paid eight in the firm, whose compensation was reported to the Securities and Exchange Commission (SEC). We coded the position of each executive in any given year with one of 35 abbreviated titles listed in table 1, which formed the basis of our hierarchy.[3]

We define a career hierarchy as a rational (complete and transitive) ordering over a set of job titles on the basis of transitions. Specifically, let J denote a finite collection of job titles, denoted $j \in \{1, \dots, J\}$. We denote the probability of switching from the jth to the kth job by p_{jk}. Supposing $p_{kj} \geq p_{jk}$, we write $j \succeq k$. We impose the property of transitivity. Thus if $p_{kj} \geq p_{jk}$ and $p_{j'k} \geq p_{kj'}$, then $j \succeq j'$. If $j \succeq k$ and $k \succeq j$, then $j \sim k$. If $j \succeq k$ but $j \nsim k$, then $j \succ k$, in which case we say that the jth job ranks higher than the kth. Thus, indifference occurs if $p_{jk} = p_{kj}$ or if, for example, $p_{kj} > p_{jk}$ (implying $j \succeq k$) but there exists a j' such that $p_{j'k} \geq p_{kj'}$ and $p_{jj'} \geq p_{j'j}$ (implying $k \succeq j$). An ordered rank is ascribed to each of the distinct indifference sets, with rank 1 topping the hierarchy.

Since there is only a finite number of jobs, the algorithm described above ensures the ranking is complete. This ranking has a second desirable property. Suppose we strengthened the requirement to say that $p_{kj} - p_{jk} \geq p$ for some $p > 0$ as a necessary condition for $j \succ k$; then, it is straightforward to show that we would end up with a coarser partition defining the hierarchy. Similarly, relaxing our definition to say that $p_{kj} - p_{jk} \geq p$ for some $p < 0$ as a sufficient condition for $j \succeq k$ would yield a coarser partition. In this respect, the definition we adopt maximizes the number of ranks.

Upon applying the algorithm to our data, summarized by the 35 job titles and the one-period-estimated probability of job transitions, 14 ranks

[3] We encountered a further 60 titles used fewer than three times each. These jobs were easy to rank within the hierarchy we constructed, but our analysis and conclusions are not affected by omitting the small number of observations involved either. We also experimented with finer partitions of job titles, refining job title by firm size (doubling the number of titles with an indicator designating big or small) and by sector (which triples the number of jobs). The main practical difficulty of increasing the number of job titles is the resulting small number of women in many job title cells. On the overall sample, we found that the transition patterns were not sensitive to the definitions of the partition we tested.

Table 1
Titles and Ranks

Code	Title	Observations Male	Observations Female
Rank 1		5,901	100
1a	Chairman of the Board and Vice Chairman of the Board		
2a	Chairman of the Board and other executive of a subsidiary/region		
2a	Chairman and Vice Chairman of a subsidiary/region		
2a	Chairman of the Board and Chief Executive Officer of a subsidiary/region		
2a	Chairman and Vice Chairman of a subsidiary/region		
Rank 2		24,570	371
3a	Chairman of the Board and President and Chief Executive Officer of the company		
3b	Chief Executive Officer of the company		
Rank 3		6,570	149
4a	President and Chief Operating Officer of the company		
5a	Chairman of the Board and Chief Financial Officer of the company		
6a	Chairman of the Board and Executive Vice President of the company		
6b	Chairman of the Board and Chief Operating Officer of the company		
Rank 4		26,711	1,518
7a	Executive Vice President of the company		
8a	Executive Vice President and Chief Operating Officer of the company		
8b	Executive Vice President and Chief Financial Officer of the company		
8c	Chief Operating Officer of the company		
Rank 5		22,295	1,384
9a	Senior Vice President of the company		
9b	President of a subsidiary/region		
9c	Executive Vice President and other executive of the company		
9d	Executive Vice President of the company and President of a subsidiary/region		
9e	Executive Vice President of the company and Chief Operating Officer of a subsidiary/region		
9e	Executive Vice President of the company and Chief Executive Officer of a subsidiary/region		
9f	President and Chief Executive Officer of a subsidiary/region		
9f	President and Chief Operating Officer of a subsidiary/region		
10a	President and Executive Vice President of the company		
Rank 6		20,025	1,510
11a	Vice President of the company		
11b	Senior Vice President and other executive of the company		
11c	Vice President and other executive of the company		
11d	Chief Financial Officer and other executive of the company		
11e	Senior Vice President and Chief Financial Officer of the company		
11f	Senior Vice President of the company and President of a subsidiary/region		
12a	Senior Vice President and Chief Operating Officer of the company		
12c	President and other executive of the company		

Table 1 (*Continued*)

Code	Title	Observations Male	Observations Female
12d	President and Chief Financial Officer of the company		
Rank 7		8,331	517
12b	Senior Vice President of the company and Chief Executive Officer of a subsidiary/region		
13a	Other executive of the company and Chief Executive Officer of a subsidiary/region		
13b	Chief Operating Officer of a subsidiary/region		
13c	Vice President and Chief Financial Officer of the company		
13d	Vice President of the company and President of a subsidiary/region		
13e	Vice President of the company and Chief Executive Officer of a subsidiary/region		
13e	Vice President of the company and Chief Operating Officer of a subsidiary/region		
14a	Chief Financial Officer		

NOTE.—Codes are the 35 abbreviated titles, and the numbers attached to the codes represent the 14 levels of a hierarchy into which these titles were partitioned. Ranks are a cruder partition of the 14 levels to make the empirical analysis manageable. "Other executive" includes titles that did not occur often enough to warrant their own category and hence were grouped together. These include, but are not limited to, General Counsel, Chief Technology Officer, Chief Information Officer, Chief Marketing Officer, and Consultant.

emerged, which are displayed in figure 1. The numbered circles in the figure are keys to the job titles in table 1, and each job title is aligned to its rank indicated on the left. To convey a sense of the life cycle flow through jobs, we have drawn arrows pointing from title j to title k if at least 2% of the executives in job j move to job k the next period. Because there are so few female executives, we further consolidated the 14 ranks into seven, as presented in table 1. Most of the hierarchy conforms more or less to the commonly held notion of the structure of the firm, with the exception that rank 1 is not the rank to which CEO belongs. Rank 2 includes the CEO position, whereas rank 1 is reserved for the chairman of the board of directors, if that position is separated from the job of CEO. In hindsight, this is quite reasonable on the basis of the reporting structure of a firm. As will become clear later when we compare compensation across this hierarchy, rank 2 (to which CEO belongs) can be considered the top of the hierarchy, and rank 1 is a type of retirement or monitoring position.

D. Measuring Total Compensation for Executives

We followed Antle and Smith (1985, 1986), Hall and Liebman (1998), Margiotta and Miller (2000), and Gayle and Miller (2009a, 2009b) by using total compensation to measure executive compensation. Total compensation is the sum of salary and bonus, the value of restricted stocks and options granted, the value of retirement and long-term compensation

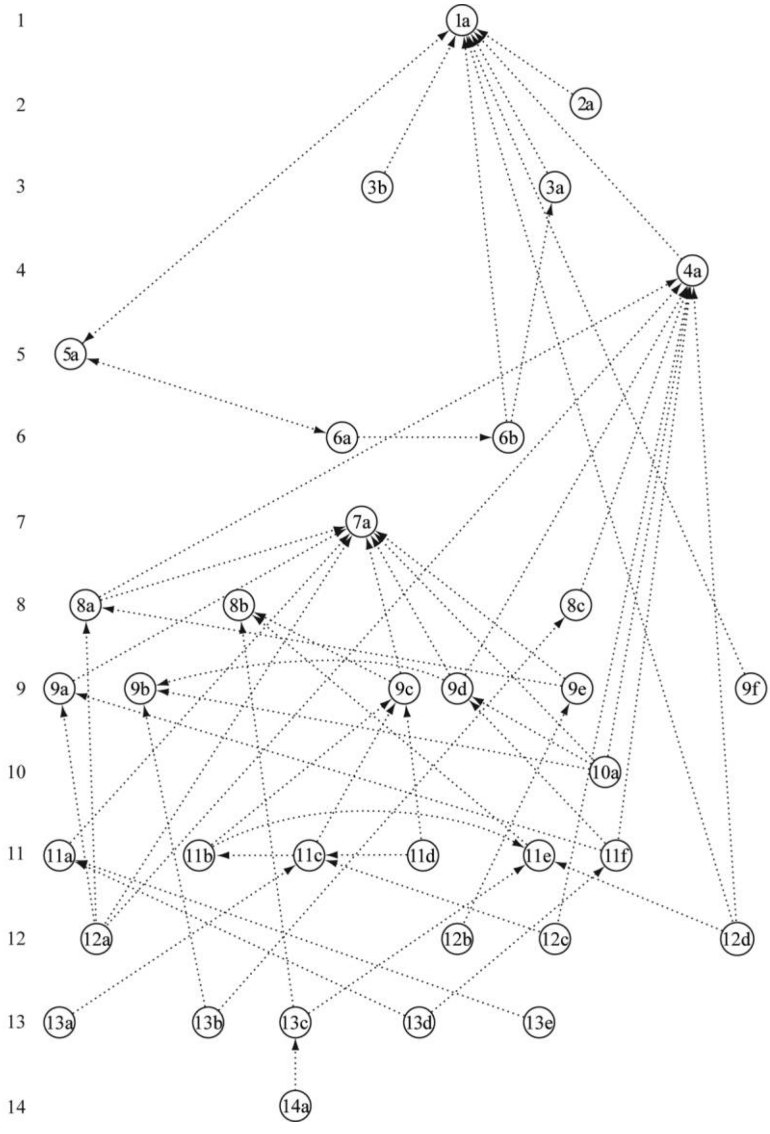

FIG. 1.—Hierarchy

schemes, plus changes in wealth from holding firm options and changes in wealth from holding firm stock relative to a well-diversified market portfolio instead. Changes in wealth from holding firm stock and options reflect the costs managers incur from not being able to fully diversify their wealth portfolios because of restrictions on stock and option sales. When forming their portfolio of real and financial assets, managers recognize that part of the return from their firm-denominated securities should be attributed to aggregate factors, so they reduce their holdings of other stocks to neutralize those factors. Hence, the change in wealth from holding their firms' stock is the value of the stock at the beginning of the period multiplied by the abnormal return, defined as the residual component of returns that cannot be priced by aggregate factors the manager does not control. In the full sample, the average total compensation is US$(2006)1.85 million, and it is four times the average executive salary, confirming the well-documented fact that more than 75% of an executive's total compensation consists of firm-denominated securities and bonuses. This ratio is even higher in the matched sample. This is because overall compensation and the fraction of nonsalary pay increases with firm size, and the average firm is larger in our matched sample than in our main sample. The characteristics of the full and matched samples are presented in table A1, available in the online version of *Journal of Labor Economics*.

E. Measuring Exit from the Occupation of Top Executives

General management is a very broad and loosely defined occupational category. The identifying feature of the managers in our study is that they are so highly paid and exercise so much discretion within their firms that their employers make available for public scrutiny their compensation records, typically determined at the highest levels by an executive compensation committee. So for the purposes of this study, we define executive management as an occupation of general managers in publicly traded firms whose compensation and financial assets in their employer firm are reported to the SEC. Although firms are only required to report on their top five executives, the SEC accepts and publishes data from firms that provide the records on more employees, and most firms do. For all such firms, the SEC requirement is not a binding constraint but a device to help the firms establish and maintain credibility with their shareholders and bondholders.

Like any tightly defined occupation, executive management is porous. People become executive managers through promotion within the firm or from another publicly traded company, transfer from a privately held company or a nonprofit organization, or coming out of retirement. They exit from executive management by retiring, by accepting less prestigious and less well-paid positions within management (having been overtaken by other executives within the company and sidelined without a title change or summarily demoted), by transferring to an organization not listed on an exchange (such as starting a sole proprietorship), or by entering another occupation (e.g., that makes more use of previously acquired professional qualifications). Nonetheless, it is instructive to compare the fortunes of top executives by gender since executive management epitomizes the pinnacle of employment within the firm. It is heavily dominated by men, but it is not their exclusive domain.

We construct a sample measure of this population's exit variable that captures the above types of exit from executive management. As such, we define our outside option called exit as an absorbing state: if an executive leaves all our data sets and does not return for 4 years, the executive is classified as exited. Note that the following examples are not classified as an exit: if an executive disappears from the sample because the firm becomes a nonpublicly traded company, if the firm drops from the COMPUSTAT data sets, if the company is merged with another company and does not report any more, if the firm goes completely out of business, or if the executive exits in the last 4 years of the sample. Less than 1% of those leaving for more than 3 years appear again in our data sets, showing that any potential right censuring is minimal. By this measure, on average 20% of our executives leave each year in the main sample, and 26% in the matched sample (see table A1).

F. Measuring Human Capital

Two types of human capital are measured and used in the analysis: formal education and job experience. There are five nondisjoint categories of formal education: no college degree, bachelor degree, master of business administration (MBA), master of science/arts (MS/MA), doctor of philosophy (PhD), and professional certification. While all the other categories are self-explanatory, it is worth noting that professional certification includes accounting, engineering, legal, financial, and other professional certifications, such as chartered public accountant or certified financial analyst.

Four measures of experience were included to capture the potential different dimensions of on-the-job training. Managerial experience is the number of years elapsed since the manager was first recorded as holding one of the 41 titles listed in table 1. Tenure is years spent working at the executive's current firm. We also track the number of different firms the executives have worked for over their careers, as well as the number of moves before becoming an executive. Promotion is an indicator variable for whether the manager was promoted in the previous year.

III. Empirical Results

This section documents gender differences in compensation and mobility patterns. Previous literature on the gender gap has conclusively shown that a major part of the gender pay gap can be attributed to gender differences in such background characteristics as education and work experience. However, existing papers on the executive pay gap do not have measures of education or work experience. In this section, we investigate whether a gender gap in executives' background characteristics exists.

We then explore the sources of the gender differences in compensation. Bertrand and Hallock (2001) find that after controlling for firm type and executive position, there is no economic or significant pay gap between female and male executives. They postulate that discrimination can still manifest itself via unequal access to promotion between men and women. We replicate Bertrand and Hallock's (2001) results and proceed to explore possible explanations for these gaps by analyzing the effect of background characteristics and the gender differences in promotions, demotions, turnover, and exit.

A. Executive Background

There are several significant differences in the background characteristics of male and female executives in our sample. Female executives are less likely to hold a college degree than their male counterparts; 23% of female executives do not have a college degree as compared to 21% of male executives. This difference is statistically significant at the 5% level. Men and women executives are equally likely to obtain an MBA, which means that a higher fraction of women with a first degree go on to get an MBA. Male executives are more likely to have an MS/MA, while female executives are more likely to have a PhD. Women are more likely to have a professional certification than are men.

On average, women have 2 years less tenure in the firm and 3.5 years less executive experience than men. Women are, on average, 3 years younger than men, they change firms less frequently than men before becoming executives, but there is no difference in the total number of firm changes. This means that women have more firm changes after becoming an executive. As noted in previous studies, there is some degree of gender segmentation by sector, with women concentrated more in the consumer goods sector while men are more concentrated in the primary sector. The genders are equally represented in the service sector. There is no significant gender difference in the size of firms. The summary measures of the background variables by firm types and by gender are displayed in table A1.

Table 2 presents the characteristics of executives by rank. For male executives, the average age declines from 60 to 52 between ranks 1 and 3 but is more or less constant as rank falls off further. Similarly, their average tenure is roughly constant in the lower and middle ranks at 14 but rises to 15 and 17 for ranks 2 and 1, respectively. The average gap between ranks 1 and 3 in executive experience for male executives is 4 years. Relative to the lower ranks, rank 1 and 2 male executives are 8 and 4 years older respectively, with only 5 and 4 years more executive experience and just 1 and 3 years more tenure, respectively. Male executives with MBA degrees are more concentrated in the top four ranks; those with other masters or PhD degrees are more concentrated in the lower ranks. Average total compensation, its salary components, and their respective standard deviations rise by more than a factor of two from rank 7 to rank 2, in

Table 2
Executive Background by Rank

Variable	Rank 1 Men	Rank 1 Women	Rank 1 $t(z)$[a]	Rank 2 Men	Rank 2 Women	Rank 2 $t(z)$[a]	Rank 3 Men	Rank 3 Women	Rank 3 $t(z)$[a]	Rank 4 Men	Rank 4 Women	Rank 4 $t(z)$[a]	Rank 5 Men	Rank 5 Women	Rank 5 $t(z)$[a]	Rank 6 Men	Rank 6 Women	Rank 6 $t(z)$[a]	Rank 7 Men	Rank 7 Women	Rank 7 $t(z)$[a]
Matched sample:																					
Exit	.35	.39	.45	.14	.19	−1.12	.21	.17	.82	.26	.33	−2.98	.30	.37	−2.86	.30	.35	−2.65	.30	.41	−2.84
Promotion	.27	.26	.21	.08	.12	−2.36	.20	.23	−1.15	.12	.13	−1.08	.07	.07	−.24	.03	.03	.38			
Turnover	.04	.04	.16	.03	.05	−1.74	.03	.04	−1.02	.02	.03	−.73	.03	.01	1.28	.01	.01	1.02	.02	.02	−.18
No college	.25	.11	2.71	.21	.21	−.12	.25	.24	.17	.21	.25	−2.56	.21	.26	−3.34	.17	.18	−.46	.21	.18	1.02
Bachelor's	.75	.89	−2.71	.79	.79	.12	.75	.76	−.17	.79	.75	2.56	.79	.74	3.34	.83	.82	.46	.79	.82	−1.02
MBA	.24	.28	−.83	.26	.25	.57	.23	.22	.20	.25	.32	−4.09	.19	.19	.00	.18	.16	1.61	.22	.22	.06
MS/MA	.16	.26	−2.43	.17	.14	1.48	.17	.22	−1.57	.20	.14	3.69	.21	.18	1.91	.21	.19	.74	.21	.14	2.24
PhD	.15	.29	−3.36	.15	.14	.38	.14	.16	−.91	.14	.11	2.18	.21	.24	−1.44	.27	.34	−4.31	.17	.19	−.53
Professional certification	.15	.18	−.68	.14	.05	4.15	.15	.10	1.87	.22	.18	2.58	.25	.24	.60	.34	.38	−2.15	.29	.37	−2.13
Age	59.70	51.80	11.20	55.80	51.60	10.38	52.40	52.00	.47	52.10	49.50	6.80	52.90	51.30	3.81	52.40	51.30	2.50	52.20	52.00	.17
	(9.80)	(5.60)		(7.60)	(6.70)		(7.90)	(9.90)		(8.80)	(9.50)		(10.00)	(10.40)		(10.30)	(10.80)		(11.10)	(13.60)	
Executive experience	22.40	13.00	8.60	20.90	18.90	2.70	18.20	14.10	3.10	15.50	13.80	3.30	18.90	15.50	3.90	17.30	14.70	4.52	16.70	15.30	1.25
	(13.30)	(8.50)		(47.40)	(10.20)		(66.00)	(9.1)		(24.00)	(11.00)		(66.60)	(12.50)		(29.60)	(11.40)		(11.70)	(13.0)	
Tenure	17.20	11.60	3.79	15.20	13.20	2.60	13.70	11.10	2.15	13.90	12.90	2.00	14.10	12.20	4.09	13.80	12.40	2.91	14.20	12.90	1.51
	(13.60)	(10.70)		(11.70)	(11.50)		(11.40)	(10.50)		(11.10)	(11.40)		(11.30)	(10.30)		(11.00)	(10.50)		(10.90)	(10.30)	
NFC	1.95	1.46	2.77	1.91	2.02	−.94	1.75	1.28	2.79	1.93	1.77	2.24	2.23	2.01	2.64	2.31	2.20	1.31	2.31	2.45	−.82
	(2.00)	(1.39)		(1.93)	(1.94)		(1.92)	(1.80)		(1.95)	(1.81)		(2.06)	(2.31)		(2.05)	(1.91)		(2.18)	(2.14)	
NFCBE	.91	.57	3.08	.93	1.18	−2.80	.73	.47	3.16	.76	.66	2.66	.78	.82	−.92	.80	.75	1.18	.84	.90	−.60
	(1.39)	(.92)		(1.39)	(1.51)		(1.29)	(1.01)		(1.30)	(1.08)		(1.33)	(.80)		(1.32)	(1.24)		(1.43)	(1.39)	
Salary	623	607	.54	730	758	−.85	552	563	−.55	408	394	2.52	379	380	−.24	302	276	7.39	320	281	5.35
	(362)	(245)		(391)	(538)		(305)	(249)		(184)	(169)		(175)	(302)		(130)	(114)		(188)	(131)	
Compensation	2,675	2,946	−.20	3,795	2,992	.68	3,729	2,965	.57	2,321	2,677	−1.33	1,979	2,282	−1.46	1,402	1,347	.43	1,678	1,461	.85
	(17,874)	(11,834)		(19,632)	(19,610)		(13,791)	(16,685)		(8,130)	(8,514)		(6,717)	(6,415)		(5,454)	(4,060)		(6,298)	(4,574)	
N	4,293	75		17,953	286		5,201	148		13,997	799		10,976	706		9,801	662		3,702	186	
Full sample:																					
Exit	.35	.35	.00	.16	.24	−1.86	.23	.18	.84	.27	.34	−3.38	.31	.37	−2.88	.31	.37	−3.53	.31	.40	−2.63
Promotion	.27	.26	.22	.08	.12	−2.39	.20	.23	−1.17	.12	.13	−.98	.07	.07	−.42	.03	.03	.35			
Turnover	.04	.04	.03	.03	.05	−1.44	.03	.04	−1.05	.02	.02	.49	.02	.01	1.03	.01	.01	.98	.02	.02	−.15
Salary	613	596	.62	707	715	−.31	535	547	−.67	395	384	2.48	369	370	−.16	294	270	7.83	309	277	5.17
	(362)	(265)		(404)	(506)		(316)	(248)		(183)	(170)		(175)	(184)		(134)	(114)		(186)	(134)	
Compensation	2,590	3,355	−.86	3,849	3,532	.33	3,464	3,808	−.40	2,107	2,238	−.60	1,866	2,008	−.80	1,279	1,289	−.08	1,489	1,122	1.60
	(16,726)	(8,633)		(18,385)	(7,909)		(13,168)	(11,830)		(7,897)	(8,192)		(6,739)	(6,352)		(5,144)	(4,750)		(6,533)	(4,930)	
N	5,900	100		24,573	371		7,903	209		25,705	1,472		22,407	1,386		20,238	1,495		7,984	513	

SOURCES.—Data are for top managers from the Standard and Poor's ExecuComp database for 1991–2006 matched with background data from the Marquis Who's Who database.

NOTE.—Standard deviations in parentheses. Salary and compensation measured in thousands of US$(2006). MBA = master of business administration; MS/MA = master of science/arts; PhD = doctor of philosophy; NFCBE = number of firm changes before becoming an executive; NFC = number of firm changes. Executives who leave all our data sets and do not return for 4 years are classified as exited.

[a] Statistic for the difference in sample means and proportions between men and women within each row: distributed t for a mean and z for a proportion.

which they are at their maximum and even across genders, and decline slightly in rank 1.

Table 2 also presents the sample means of executives' background characteristics, compensation, and firm characteristics by rank and gender. We focus on the gender differences in educational attainment, age, and job experience. The table shows that the gender differences in background characteristics are not constant across ranks. Women in rank 1 are more educated than their male counterparts. Women and men CEOs (rank 2) are equally educated, and the same is true of executives in rank 3. At the lower ranks (i.e., ranks 3–7), the results are less clear; depending on the type of educational attainment, male or female executives may be considered more educated. In rank 4 women are less likely to have a college degree, MS/MA, PhD, or a professional certification, whereas they are significantly more likely to have an MBA than are men. In ranks 5–7, women are less likely to have a college degree than are men. However, women are similar to men on other dimensions of educational attainment. In rank 6, women and men are similar on all dimensions of educational attainment, except that women are more likely to have a PhD and to be professionally certified. This pattern changes again in rank 7, with men and women equally likely to graduate from college, men more likely to have an MBA, and women more likely to have a PhD.

The age difference between men and women declines with rank and is eventually eliminated by rank 7. The exception to this general pattern is rank 3, where there is no significant gender age difference. A similar pattern to age obtains for managerial experience, except that the gender difference is only equalized at rank 7 and is much larger than the gender difference in age in rank 1. Men have almost 10 years more managerial experience than women in rank 1; this difference falls to 2 years by rank 2. A similar pattern holds for tenure. Women worked in fewer firms than men in every rank, with the exception of ranks 2, 6, and 7. It is worth pointing out that women and men CEOs (i.e., rank 2) are the same along this dimension, which is not true for the other experience variables considered; in fact, women CEOs worked in more firms before becoming an executive than did men.

In summary, female and male executives look very different in terms of educational attainment, age, and work experience. See Mincer and Polachek (1974), O'Neill and Polachek (1993), Wellington (1993), and Gayle and Golan (2012) for similar findings for nonexecutives. These differences vary by rank and are smallest in rank 2 and in low-level ranks.

B. Compensation

In the full sample, men earn on average \$80,000 more than women in salary and \$540,000 more than women in total compensation. In the matched sample, men earn on average \$84,000 more in salary and \$440,000 more in total compensation (see table A1). Table 2 describes salary and total compensation by rank and gender, showing that, controlling for rank, there is no gender pay difference in ranks 1, 2 (i.e., CEOs), 3, and 5. In ranks 4, 6, and 7, men are paid more than women in salary but not in total compensation. These results are consistent with Bertrand and Hallock (2001), who find no gender pay gap after controlling for the executives' rank.

Since men and women differ with respect to their background characteristics, we further explore the conditional gender pay gap. Table 3, columns 1–6, presents the median regression estimates of gender's effect on total compensation, showing that including measures of educational attainment, age, and job experience in the compensation equation dramatically increases the compensation premium paid to female executives and their pay-for-performance sensitivity relative to male executives. It also suggests that the compensation premium paid to female executives is related to female executives' higher pay-for-performance sensitivity, relative to their male counterparts.

The results in table 3, column 1, show that, without including any firm, sector, and executive-characteristic controls, the median female executive is paid about $111,000 less than her male counterparts. Column 2 adds measures of rank, abnormal return, age, firm size, and sector, showing that there is a statistically insignificant female premium of $41,000. The female pay is less sensitive to the firm's performance: female executives earn about $253,000 less than male executives for a 1% increase in their firms' abnormal return. Including these variables increases the regression's R^2 to 24% from 1%. Column 3 shows that adding measures of executive educational attainment and job experience increases the female premium to $92,000, while the gender gap in pay-for-performance sensitivity increases to $286,000 for a 1% increase in the firm's abnormal return. The R^2 of the regression increases slightly to 25%. Column 4 adds gender interactions with the measures of job experience and educational attainment: the female premium increases to $266,000, and the gender gap in pay-for-performance sensitivity increases to $327,000 per 1% increase in the firm's abnormal return. Column 4 further shows that the returns to job experience do not differ by gender, but the returns to education do. Female executives receive $256,000 more per year in compensation than their male counterparts if they do not have a college degree and $292,000 less than men if they have an MBA degree.

To further explore the gender differences in pay for performance, table 3, column 5, adds a dummy variable that takes the value of one if the abnormal return of the firm is negative, an interaction of the negative return dummy with abnormal returns, the negative abnormal return dummy interaction with gender, and an interaction of the negative return dummy with both abnormal return and gender. It shows that both the female pay premium and the gender gap in pay for performance disappear. The female pay premium now loads on the female negative return dummy, and the gender gap in pay-for-performance sensitivity is reversed; female executives are insured against negative abnormal return by being paid $309,000 more than male executives when the abnormal return is negative. They also received $489,000 more (less) than their male counterparts for a 1% increase (decrease) in their firms' abnormal return. Column 5 also shows that there is no difference between male and female executives' pay for performance when abnormal return is negative. These results contradict Albanesi and Olivetti's (2008) findings that female executives are punished more for negative returns but are rewarded less for positive returns. To determine whether the differences stem from inclusion of background characteristics or because we use a more comprehensive measure of total compensation than that used in Albanesi and Olivetti (2008), we repeat the exercise in column 5 excluding the measures of executive background. The results are presented in column 6, showing that there is a negative and insignificant female premium, but female executives are rewarded more for positive abnormal returns and punished less for negative abnormal returns than their male counterparts.[4]

Table 3, columns 7–11, presents the median regression estimates of the effect of gender on salary. It shows that there is a significant gender gap in salary of $10,000, even when one includes measures of executive background. However, this gender salary gap disappears when we allow for gender-specific returns to education and job experience. Column 7 does not include any control for rank, firm characteristics, sector, or executive background characteristics, indicating that the median woman is paid about $77,000 less than her male counterpart in salary. Column 8 adds measures of rank, abnormal return, age, firm size, and sector; the gender effect decreases to a (statistically insignificant) $10,000 salary gap, and female executives have the same salary-for-performance sensitivity as their male counterparts. Column 9 adds measures of educational attainment and job experience, indicating no change in the results from column 8.

[4] These results were also confirmed using direct compensation, which is a less comprehensive measure (not reported here). Direct compensation is the total compensation excluding changes in wealth from holding firm options and stocks relative to holding a well-diversified market portfolio instead. The direct compensation regressions show that women are paid a positive but statistically insignificant compensation premium in all specifications except specification 1; the results on pay-for-performance sensitivity of female relative to male executives are similar to those found in table 3. These results further support our conclusion that the compensation premium paid to female executives is related to gender difference in pay-for-performance sensitivity since the only difference between direct compensation and total compensation is the variation related to the fluctuation in value of the firm-denominated securities.

Table 3
Median Regression Estimates of the Effect of Gender

	Dependent Variable: Yearly Total Compensation, 1992–2006						Dependent Variable: Yearly Salary, 1992–2006				
	(1)	(2)[a,b]	(3)[a,c]	(4)[a,c]	(5)[a,c]	(6)	(7)	(8)[a,b]	(9)[a,c]	(10)[a,c]	(11)[a,c]
Female	−111.08	41.09	91.73	266.52	−1.45	−95.89	−77.69	−10.80	−10.69	20.29	12.15
	(60.77)	(42.56)	(45.91)	(133.50)	(147.66)	(67.80)	(6.23)	(4.35)	(4.68)	(12.56)	(14.44)
Negative ab. return dummy × female					308.96	131.29					−3.54
					(130.89)	(103.00)					(12.75)
Ab. return × female		−253.24	−286.29	−327.35	489.53	312.85					−13.44
		(69.20)	(75.04)	(82.65)	(114.88)	(82.70)					(26.60)
Ab. return × negative ab. return dummy × female					−475.17	−547.87		6.24	9.13	6.70	−2.23
					(279.99)	(214.59)		(6.48)	(6.99)	(6.89)	(8.71)
No college × female				256.32	119.65					53.77	62.50
				(143.80)	(135.75)					(13.16)	(13.45)
MBA × female				−291.93	−249.66					−29.19	−30.60
				(132.23)	(125.12)					(12.03)	(12.39)
MS/MA × female				87.84	85.58					−.75	2.88
				(136.01)	(127.89)					(12.42)	(12.72)
PhD × female				83.14	42.22					22.51	26.67
				(134.73)	(127.44)					(12.360)	(12.67)
Professional certification × female				−192.72	−130.18					−22.864	−24.14
				(124.86)	(118.20)					(11.45)	(11.73)
Exec. exp. × female				−7.92	−10.33					−1.18	−.65
				(7.49)	(7.06)					(.69)	(.70)
Tenure × female				.93	5.75					−.47	−.85
				(8.09)	(7.62)					(.74)	(.75)

NFC × female				−14.35	−26.85					−4.20	−2.72
				(36.21)	(34.05)					(3.32)	(3.41)
NFCBE × female				60.71	84.34					6.47	2.39
				(62.72)	(59.15)					(5.71)	(5.86)
Experience variables	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Rank dummies	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Ab. return	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Ab. return-rank interactions	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Negative ab. return dummy	No	No	No	No	Yes	Yes	No	No	No	No	Yes
Ab. return × negative ab. return dummy	No	No	No	No	Yes	Yes	No	No	No	No	Yes
Education variables	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Exp.-gender interactions	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Educ.-gender interactions	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Return-exp. interactions	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Return-educ. interactions	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Firm-level variables	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Return-firm interactions	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
N	58,110	48,065	35,893	35,893	35,893	48,065	59,256	49,112	36,625	36,625	36,625
R^2	.01	.24	.25	.26	.26	.24	.003	.37	.37	.39	.39

SOURCES.—Standard and Poor's ExecuComp, COMPUSTAT, and Marquis Who's Who databases.

NOTE.—Standard errors in parentheses. Compensation and salary are measured in thousands of US$(2006). We apply a 1% trim for outliers. Negative abnormal (ab.) return dummy equals one if the abnormal return is less than zero and zero otherwise. Abnormal return is measured as a fraction between −1 and 1. Education (educ.) variables are no college, master of business administration (MBA), master of science/arts (MS/MA), doctor of philosophy (PhD), and professional certification. Firm-level variables are sector, assets, and number of employees. Experience (exp.) variables are turnover, managerial experience (exec. exp.), tenure, firm changes before becoming an executive (NFCBE), and total number of firm changes (NFC).

[a] Includes age, age^2, and age interacted with abnormal return.

[b] Excludes firms whose stock prices are not available for two consecutive periods.

[c] Excludes executives who are not observed for two consecutive periods.

Column 10 adds gender interactions with the measures of job experience and educational attainment, showing that the gender salary gap disappears but that there is still a gender gap in salary-for-performance sensitivity. It also shows that the returns to job experience do not differ by gender, whereas the returns to educational attainment do. Column 11 adds a dummy variable for negative abnormal return, an interaction of the negative return dummy with abnormal returns, the negative abnormal return dummy interacted with gender, and an interaction of the negative return dummy with both abnormal return and gender. There are, however, no significant changes in the results from column 10.

C. Mobility

The results in table 3 do not rule out the possibility of gender discrimination; fewer women than men make it to the top of the hierarchy, and this could be a channel of gender discrimination. Tables 4 and 5 present the internal and external transition-probability matrices by gender, respectively. The two most conspicuous features of these tables are the small fraction of women versus men in rank 1 and the high incidence of women CEOs (rank 2) who change firms and remain CEOs compared to men. Only 57% of male CEOs who change firms remain CEOs in their new firm, while 93% of female CEOs remain CEOs in their new firm. We performed a chi-squared test of the gender differences in transitions and found that both internal and external transitions differ significantly by gender.[5] We then excluded rank 1 from consideration and found that the internal transitions, but not the external transitions, differ significantly by gender.

The above results do not take into consideration executive and firm characteristics, which we explore in the following regressions. We first estimated the effect of gender on the one-period transitions (see table A2, available in the online version of *Journal of Labor Economics*). We found that there are significant gender differences in both the external and the internal transition, conditional on executive and firm characteristics, but it is difficult to ascertain whether female executives are disadvantaged relative to male executives from these estimates. For example, female executives in rank 2 (i.e., CEOs) are less likely than males to move to ranks 3, 6, and 7 internally, relative to remaining in rank 2, but they are more likely than men to move internally to rank 4. Conditional on changing firms, women are more likely than men to move to rank 2, but this is not true for any other given position. In light of these results, we esti-

[5] We repeated the test for the normalized transition matrix because there are significantly more male than female executives. The normalized transition test excludes all same-rank transitions from consideration. This, in effect, normalized for the number of men and women in each rank and hence on the executives who change ranks. This did not affect our results.

Table 4
Transition Probability Matrices for Internal Moves: Percent from Base Rank

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	*N*
Male:								
Rank 1	88.70	4.77	3.24	1.46	1.10	.34	.39	3,833
Rank 2	3.41	96.09	.24	.15	.06	.01	.04	19,598
Rank 3	2.88	13.40	78.87	2.47	1.36	.56	.46	6,043
Rank 4	1.01	2.18	3.26	86.74	4.06	1.65	1.09	18,635
Rank 5	.99	.88	2.36	7.20	85.11	2.28	1.18	15,396
Rank 6	.16	.44	.91	6.28	6.29	83.96	1.97	14,342
Rank 7	.24	.57	1.48	6.14	3.62	6.90	81.06	5,476
N	4,621	20,461	6,119	18,743	15,095	13,127	5,157	83,323
Female:								
Rank 1	81.82	6.06	6.06	1.52	.00	.00	4.55	66
Rank 2	.75	98.51	.00	.00	.37	.00	.37	268
Rank 3	2.60	9.74	79.22	3.90	1.95	2.60	.00	154
Rank 4	.72	.82	2.46	87.06	5.75	1.95	1.23	974
Rank 5	.35	.69	1.27	8.99	85.02	2.07	1.61	868
Rank 6	.00	.21	.31	4.15	6.01	87.15	2.18	965
Rank 7	.00	.65	.00	6.17	2.92	8.12	82.14	308
N	70	301	164	992	865	907	304	3,603

Table 5
Incidence of Turnover between Firms: Percent from Base Rank

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	*N*
Male:								
Rank 1	48.56	34.16	8.23	7.00	2.06	.00	.00	243
Rank 2	17.84	57.12	10.63	6.31	6.67	1.08	.36	555
Rank 3	8.23	40.33	22.22	14.81	10.70	1.23	2.47	243
Rank 4	2.46	20.33	6.39	38.36	13.93	11.80	6.72	610
Rank 5	2.10	28.74	9.11	18.69	31.07	7.01	3.27	428
Rank 6	.28	9.44	5.00	28.89	12.78	33.89	9.72	360
Rank 7	.64	11.46	5.73	28.66	10.83	21.66	21.02	157
N	263	797	238	551	349	267	131	2,596
Female:								
Rank 1	.00	50.00	.00	50.00	.00	.00	.00	2
Rank 2	.00	92.86	.00	.00	7.14	.00	.00	14
Rank 3	.00	25.00	.00	75.00	.00	.00	.00	4
Rank 4	5.71	5.71	2.86	45.71	17.14	11.43	11.43	35
Rank 5	7.14	10.71	17.86	25.00	21.43	10.71	7.14	28
Rank 6	.00	.00	5.56	38.89	11.11	33.33	11.11	18
Rank 7	.00	.00	16.67	33.33	.00	33.33	16.67	6
N	4	20	8	36	15	15	9	107

mated binary logits on promotion, demotion, and turnover to get a better sense of gender differences in directional changes in mobility between men and women.

Table 6 presents the binary logit coefficient estimates of the effect of gender on one-period promotions, demotions, and turnover. It implies that women are 27% more likely to be promoted than men internally and

Table 6
Binary Logit Coefficient Estimates of the Effect of Gender on Promotion, Demotion, and Turnover

	Promotion[a]			Demotion[b]			Turnover[c]		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	2.603	2.474	2.725	−2.343	−2.418	−2.253	−5.928	−5.827	−6.653
	(.232)	(.238)	(.288)	(.643)	(.661)	(.843)	(.861)	(.866)	(1.163)
Female	.139	3.287	3.131	.332	1.858	2.031	−12.405	−29.657	−21.912
	(.204)	(1.178)	(1.432)	(.426)	(3.023)	(3.355)	(40.810)	(42.723)	(86.321)
Rank 1				2.176	2.179	2.254	1.037	1.031	.872
				(.133)	(.134)	(.162)	(.172)	(.172)	(.203)
Rank 2	−1.122	−1.124	−1.130	−.592	−.592	−.527	−.018	−.019	−.105
	(.043)	(.043)	(.050)	(.151)	(.151)	(.182)	(.156)	(.156)	(.182)
Rank 3	−.122	−.124	−.159	1.051	1.050	1.131	.273	.274	.270
	(.051)	(.051)	(.061)	(.142)	(.142)	(.171)	(.174)	(.174)	(.202)
Rank 4	−.217	−.218	−.230	1.535	1.534	1.620	.216	.217	.125
	(.042)	(.042)	(.049)	(.117)	(.117)	(.140)	(.158)	(.158)	(.185)
Rank 5	.087	.087	.089	.865	.864	.945	−.013	−.012	−.098
	(.042)	(.042)	(.049)	(.132)	(.132)	(.157)	(.166)	(.166)	(.195)
Rank 6	.033	.033	−.005				−.095	−.095	−.113
	(.044)	(.044)	(.051)				(.170)	(.170)	(.197)
Rank 1 × female				.490	.550	.832	11.700	11.523	
				(.679)	(.687)	(.845)	(40.821)	(42.712)	
Rank 2 × female	.005	.086	.139	−.707	−.654	−.536	13.058	12.855	14.151
	(.283)	(.287)	(.326)	(1.105)	(1.109)	(1.135)	(40.801)	(42.720)	(86.300)
Rank 3 × female	−.242	−.183	.080	.297	.319	.664			
	(.313)	(.315)	(.402)	(.636)	(.639)	(.723)			
Rank 4 × female	.098	.131	.082	.177	.210	−.021	12.710	12.583	14.112
	(.233)	(.236)	(.269)	(.475)	(.478)	(.502)	(40.821)	(42.700)	(86.331)
Rank 5 × female	−.088	−.052	.054	−.326	−.312	−.301	12.956	12.843	13.941
	(.235)	(.237)	(.271)	(.557)	(.557)	(.597)	(40.800)	(42.700)	(86.300)

Rank 6 × female	−.267	−.231	−.259				11.806	11.756	13.387
	(.237)	(.239)	(.272)				(40.801)	(42.700)	(86.308)
External	2.064	2.063	1.986	2.138	2.138	2.091			
	(.069)	(.069)	(.081)	(.107)	(.107)	(.130)			
External × female	−.331	−.283	−.744	−.149	−.115	−1.021			
	(.370)	(.372)	(.420)	(.562)	(.564)	(.851)			
Age	−.098	−.093	−.101	−.054	−.051	−.058	.098	.093	.132
	(.008)	(.008)	(.010)	(.023)	(.023)	(.029)	(.031)	(.031)	(.042)
Age^2	.001	.001	.001	.000	.000	.000	−.001	−.001	−.001
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Age × female		−.113	−.123		−.063	−.072		.722	.335
		(.041)	(.050)		(.105)	(.118)		(.505)	(.447)
Age^2 × female		.001	.001		.001	.001		−.007	−.004
		(.000)	(.000)		(.001)	(.001)		(.005)	(.004)
Experience variables	No	No	Yes	No	No	Yes	No	No	Yes
Experience-gender interaction	No	No	Yes	No	No	Yes	No	No	Yes
Education variables	No	No	Yes	No	No	Yes	No	No	Yes
Education-gender interactions	No	No	Yes	No	No	Yes	No	No	Yes
N	40,840	40,840	30,343	33,564	33,564	24,883	34,705	34,705	25,732

NOTE.—Standard errors in parentheses. We used the matched sample with all observations for executives coded for two consecutive time periods. All regressions include sectorial dummies, assets, employees, compensation last period, education variables, and job-experience variables.

[a] Binary variable equal to one if an executive moved to a higher rank next period and zero otherwise. Promotion is not defined for rank 1 executives.

[b] Binary variable equal to one if an executive moved to a lower rank next period and zero otherwise. Demotion is not defined for rank 7 executives.

[c] Binary variable equal to one if an executive changed firms from one period to the next. Sample is the same as for promotion but includes observations on all ranks including rank 1.

are promoted at the same rates externally, while there is no gender difference in the rate of demotion and turnover. Column 1 includes neither educational attainment nor job experience variables and indicates no significant gender differences in the rates of internal and external transitions. Column 2 adds gender-age interactions, making the internal female effect larger and significant. The external female effect remains insignificant. There is now a negative female effect on age, showing that younger women are more likely to be promoted than younger men. Column 3 shows that this general pattern is repeated even when educational attainment, job experience, and gender interaction variables are included. Columns 4–6 show that there are no gender differences in demotions; columns 7–9 show that there are no gender differences in turnover.

We find significant differences between male and female mobility rates that, on the surface, seem to favor women. Women are promoted more than men internally and at the same rate externally. In addition, women are promoted at a younger age.

D. Occupation Exit Rates

An important question in the gender-gap literature is whether women have weaker attachment to their jobs and the labor market than men do. For example, Gayle and Golan (2012) shows that weaker labor market attachment among women accounts for the gender earnings gap at early ages. Here, we analyze this question in the market for executives, who are normally beyond childbearing age. Thus, we do not attribute exit to fertility and child-care considerations.

In both the matched and the full samples, women exit the executive occupation at a higher rate than men; in the matched sample, there is a 5% difference in the exit probability, and 3% in the full sample (see table A1). Table 2 shows that most of this difference in exit rate can be attributed to exit at the lower ranks. There is no difference in the occupation exit rates in ranks 1, 2, and 3, but women exit the occupation at a substantially higher rate in all other ranks. Table 7 presents the binary logit coefficient estimates of the effect of gender on the occupation exit rate. It shows that, controlling for executives and firms characteristics, women at all ranks exit the executive occupation at higher rates than men. Column 1 includes neither educational attainment nor job experience variables and indicates that women at all ranks are 76% more likely to exit the executive occupation than similar men. Column 2 adds education and job experience variables and gender interactions, showing that the female effect increases to 158%.

Table 7 also shows that all executives are less likely to exit the occupation when their firms do well; the coefficient estimates on abnormal return and lagged abnormal return are both negative and significant. To examine whether women executives are judged more harshly than their

Table 7
Binary Logit Coefficient Estimates of the Effect of Gender on Occupation Exit Rates

	(1)	(2)	(3)	(4)	(5)
Constant	−2.238	−2.313	−2.313	−2.631	−2.612
	(.348)	(.416)	(.416)	(.420)	(.420)
Female	.650	1.119	1.127	1.124	1.076
	(.341)	(.499)	(.500)	(.519)	(.521)
Abnormal return	−.203	−.149	−.148	.126	.121
	(.039)	(.042)	(.043)	(.045)	(.045)
Abnormal return × female			−.015	.064	.049
			(.236)	(.308)	(.305)
Negative return				−.991	−.908
				(.107)	(.114)
Negative return × female				−.090	−.350
				(.675)	(.694)
CEO's negative return					−.441
					(.205)
CEO's negative return × female					1.920
					(1.455)
Abnormal return lagged	−.157	−.166	−.168	−.171	−.171
	(.033)	(.038)	(.038)	(.037)	(.037)
Abnormal return lagged × female			.082	.093	.088
			(.214)	(.210)	(.211)
Rank 1	.244	.288	.288	.301	.299
	(.091)	(.103)	(.103)	(.103)	(.103)
Rank 2	−.998	−.967	−.967	−.981	−1.087
	(.084)	(.095)	(.095)	(.096)	(.108)
Rank 3	−.446	−.393	−.393	−.395	−.395
	(.101)	(.116)	(.116)	(.116)	(.116)
Rank 4	−.116	−.091	−.091	−.087	−.088
	(.081)	(.092)	(.092)	(.092)	(.092)
Rank 5	.056	.058	.058	.068	.067
	(.081)	(.092)	(.092)	(.092)	(.092)
Rank 6	−.065	−.060	−.060	−.055	−.055
	(.083)	(.093)	(.093)	(.093)	(.093)
Rank 1 × female	−.645	.434	.441	.571	.593
	(.803)	(1.032)	(1.033)	(1.041)	(1.043)
Rank 2 × female	−.220	−.276	−.267	−.355	.257
	(.543)	(.625)	(.629)	(.638)	(.768)
Rank 3 × female	−.828	−.647	−.646	−.616	−.632
	(.545)	(.788)	(.790)	(.795)	(.798)
Rank 4 × female	−.148	.188	.179	.267	.276
	(.403)	(.504)	(.506)	(.512)	(.513)
Rank 5 × female	−.296	−.020	−.033	−.001	.004
	(.389)	(.475)	(.477)	(.482)	(.483)
Rank 6 × female	−.367	.010	.005	.090	.094
	(.388)	(.471)	(.473)	(.479)	(.481)
Experience variables	No	Yes	Yes	Yes	Yes
Experience-gender interactions	No	Yes	Yes	Yes	Yes
Education variables	No	Yes	Yes	Yes	Yes
Education-gender interactions	No	Yes	Yes	Yes	Yes

NOTE.—Standard errors in parentheses. Exit is an absorbing state, so executives who leave all our data sets and do not return for 4 years are classified as exited. Exit is a binary variable equal to one in the year an executive exits the data set. The sample excludes the last 3 years of data. All regressions include sectorial dummies, assets, employees, compensation last period, and two lags of excess returns. Education variables are dummies for no college, master of business administration (MBA), master of science/arts (MS/MA), doctor of philosophy (PhD), and professional certification. Experience variables are years of managerial experience, years of tenure with the firm, number of past firm changes before becoming an executive, and total number of past firm changes. CEO = chief executive officer; N = 19,307.

male counterparts, perhaps because they attract more scrutiny in an occupation dominated by males, we add interaction terms of female and abnormal return. The results reported in column 3 show that the female coefficient is small and statistically insignificant, indicating that there is no significant gender difference in the likelihood of exit when the firm performs worse than the market. Column 4 adds negative abnormal return and gender interactions without changing the previous results. Column 5 adds CEO and female interaction terms with negative abnormal return; while CEOs are more likely than other executives to exit when the firm performs badly, we do not find evidence for gender differences.

E. Summary and Robustness

The above empirical analysis shows that female and male executives differ with regard to educational attainment and job experience. Female executives are on average 2 years younger and have less job experience by most measures. It also shows that conditional on firm and executive characteristics, female executives are paid more in total compensation and have higher pay for performance than their male counterparts. The higher pay is related to the higher volatility in pay induced by the higher pay for performance. In terms of mobility, women are promoted at a higher rate than men but also exit at a much higher rate. These findings, however, are based on the matched sample, which is not completely representative of the full sample. While the magnitudes are different, the qualitative features of the full sample are preserved by the matched sample (see table A1). The main differences between the full and the matched samples are the exit rates, compensation, and firm size. The exit rates are higher in the matched sample, but the differences between male and female executives are qualitatively similar. The compensation is also higher in the matched sample, and the executives are drawn from larger firms. These two features are intertwined in that compensation is positively related to firm size. Table 2 shows the characteristics of the full sample by rank. The magnitudes are again different from the matched sample, but the qualitative patterns are similar. Conditional on rank, there are no differences in total compensation by gender between the samples. Thus, our analysis of the results from the matched sample might overstate the magnitude of the gender differences, but we are confident that the qualitative patterns are reflected in the full sample.

IV. Decomposition

Our empirical results suggest that three main factors might explain the findings that female executives earn less than their male counterparts, even though they are paid significantly more at most ranks for the same experience and their overall rate of promotion is greater than men's. First, women have different characteristics than men when they become top executives. Notably, they differ in their mix of experience, which might affect their career trajectories through the executive ranks. Second, in a profession that rewards experience, given the same background and experience, women are more likely to exit the occupation. Third, within the firm, women are promoted at younger ages, and more quickly, than men. We analyze the effects of these three factors, by constructing a dynamic system from the estimated equations obtained in the previous sections. This system provides the basis for conducting a statistical decomposition that quantifies the effect of each of these factors on the gender differences in the length of careers, how high executives of different types climb the career ladder, how executive compensation evolves with rank and over time, and lifetime compensation.

A. Framework

Let h denote a set of state variables characterizing firm-specific and general human capital that helps determine compensation and job transitions between and within firms. To quantify comparisons between female and male executive careers, it is convenient to let an f superscript stand for women and an m superscript stand for men when referring to an executive of gender $g \in \{f, m\}$. Let $p_t^{(g)}(r', h'|r, h)$ denote the joint probability that an executive aged $t \in \{t_0, t_0 + 1, \ldots\}$ holding rank $r \in \{1, 2, \ldots, R\}$ and experience $h \in H$ moves to rank $r' \in \{1, 2, \ldots, R\}$ and acquires experience $h' \in H$ next period, conditional on remaining in executive management for another period. Let $p_{tr0}^{(g)}(h)$ denote the corresponding probability of exiting the occupation at age t from rank r and $q^{(g)}(t_0, r, h)$ denote the joint distribution of r and h at some starting age t_0. Then $q^{(g)}(t, r, h)$—the joint probability that a person who was an executive at age t_0 is still in the executive population at age t and at that age holds rank r and has experience h—is recursively defined by

$$q^{(g)}(t+1, s, h') = \sum_{h=1}^{H} \sum_{r=1}^{R} p_t^{(g)}(s, h'|r, h)[1 - p_{tr0}^{(g)}(h)]q^{(g)}(t, r, h). \quad (2)$$

Hence, the survivor function, denoted by $Q_t^{(g)}$, can be expressed as

$$Q_t^{(g)} = \sum_{r=1}^{R} \sum_{h=1}^{H} q^{(g)}(t, r, h). \quad (3)$$

Summing over $Q_t^{(g)}$, we obtain the expected future duration in management for an executive at age t_0 defined by

$$T_{t_0}^{(g)} \equiv \sum_{t=t_0}^{\infty} Q_t^{(g)}. \quad (4)$$

Finally, let $w_{tr}^{(g)}(h)$ denote compensation as a function of human capital, rank, and age. The expected undiscounted cumulative earnings at age t_0 are therefore

$$W_{t_0}^{(g)} \equiv \sum_{t=t_0}^{\infty} \sum_{r=1}^{R} \sum_{h=1}^{H} w_{tr}^{(g)}(h) q^{(g)}(t, r, h). \tag{5}$$

Hence, the expected compensation per period, averaged over time spent in the occupation, is $T_{t_0}^{(g)-1} W_{t_0}^{(g)}$. We use this framework to conduct dynamic decompositions, illustrating the quantitative impact of different features of the background variables; wage regressions; transition probabilities for promotions, demotions, and firm mobility; and occupation exit rate on the gender gap in executive careers.

B. The Effect of Occupation Exit

In principle, the differential occupation exit rates, rank transition probabilities, or initial conditions can explain the men's longer duration in executive management. The differential occupational exit rates between the genders can create a spurious gap in average lifetime compensation if average compensation rises with ranks that are defined using a life cycle criterion. The empirical results show that women are 158% more likely to exit the occupation than men. To illustrate the quantitative importance of this point, we computed the survivor rates for the population and showed how they are affected by different features of gender-specific behavior.

In our empirical model, there are seven ranks ($R = 7$). Executive experience (EEXP_t), tenure with the firm (TEN_t), the number of firm changes (NFC_t), and the number of firm changes before becoming an executive (NFCBE_t) are affected by past outcomes and also help determine future outcomes. We define experience by $h_t \equiv (\text{EEXP}_t, \text{TEN}_t, \text{NFC}_t, \text{NFCBE}_t)$. By definition, h_t follows the law of motion:

$$h_{t+1} = k_t \Gamma_1(h_t) + (1 - k_t)\Gamma_0(h_t),$$

where $k_t \in \{0, 1\}$ is an indicator variable for staying in the firm versus moving to another firm and

$$\Gamma_1(h_t) \equiv (\text{EEXP}_t + 1, 0, \text{NFC}_t + 1, \text{NFCBE}_t),$$
$$\Gamma_0(h_t) \equiv (\text{EEXP}_t + 1, \text{TEN}_t + 1, \text{NFC}_t, \text{NFCBE}_t).$$

Estimates of experience and rank, $p_{tr0}(h)$, the exit rate as a function of the same variables, and $p_t(s, h'|r, h)$—the rank-and-experience transition probability—were found by integrating the exit hazard and transition probability with respect to the remaining variables: educational background, firm size, sector characteristics, and excess returns.

Since age is a significant determinant of compensation and rank, we computed all our measures for executives who were in executive management at the median age, 49, and also at the 20th percentile, 39. Table A3, available in the online version of *Journal of Labor Economics*, displays the probability distribution over the ranks and backgrounds of executives by gender for those two age groups. The top two ranks include 13% of the 39-year-old men compared to 1% of the women at that age. At age 49, however, 22% of the men are at the top two positions, whereas 12% of women are in those ranks. Yet, 39-year-old women have as much managerial experience as their male counterparts, while 49-year-old women have a little less. Controlling for age, women have slightly less tenure and exhibit more job movement.

Figure 2 depicts the survival function by gender, $Q_t^{(g)}$, found by substituting $q^{(g)}(t, r, h)$ for $q(t, r, h)$ in equation (3), for $t_0 = 39$ and $t_0 = 49$ (see also the first panel in table A4, available in the online version of *Journal of Labor Economics*). At both ages, just over one-third of female executives leave after 1 year, and only about 10% survive 6 years or more. The survivor rate for men is much higher. Over 80% last more than a year, and more than 20% last longer than 6 years, with the older group of men experiencing less exit than younger ones. From our estimates of the survivor function, we computed $T_{t_0}^{(g)} \equiv \sum_{t=t_0}^{75} Q_t^{(g)}$, the gender-specific analogue to equation (4), which is the total expected future career length for an executive of gender $g \in \{m, f\}$ and age t_0. The top two entries in each panel of table 8 show that regardless of the method of selection, being an executive manager at age 49 or being an executive manager at age 39, the expected remaining duration in executive management is just over 3 years for women and about 5 for men, almost 2 years longer for men versus women.

Suppose women changed in just one respect, by following the exit behavior of men. That is, instead of the discrete hazard $p_{tr0}^{(f)}(h)$, we now suppose that $p_{tr0}^{(m)}(h)$ applied. Denoting the defective probability distribution for describing the survivors in this counterfactual by $q^{(f,\text{exit})}(t, r, h)$, we computed estimates of $q^{(f,\text{exit})}(t, r, h)$ from the recursion

$$q^{(f,\text{exit})}(t+1, s, h') = \sum_{h}^{H} \sum_{r=1}^{R} p_t^{(f)}(s, h'|r, h)[1 - p_{tr0}^{(m)}(h)]q^{(f,\text{exit})}(t, r, h) \quad (6)$$

by replacing $p_{tr0}^{(f)}(h)$ with $p_{tr0}^{(m)}(h)$ and $q^{(f)}(t, r, h)$ with $q^{(f,\text{exit})}(t, r, h)$ in equation (2). Summing $q^{(f,\text{exit})}(t, r, h)$ over h and r, we obtained the survivor function for women when they leave from the sample population at the same rate as men given the same experience and rank. From figure 2, we see that this counterfactual exercise practically closes the gender gap between the survivor functions. Reflecting the importance of this factor,

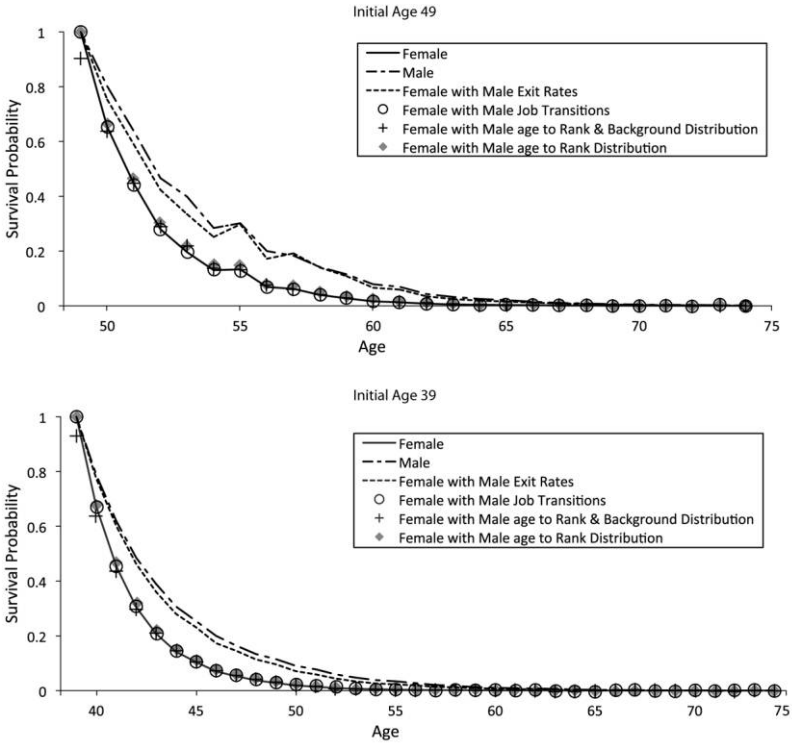

FIG. 2.—Executives' survival probabilities. Color version available as an online enhancement.

table 8 shows that the expected career duration increases from 1.5 years to about 4.5 years, not quite equalizing the expected career lengths for the genders.

Another counterfactual, which speaks to the question of why women tend to have shorter careers, is to replace $p_t^{(f)}(s, h'|r, h)$ with $p_t^{(m)}(s, h'|r, h)$ in equation (2) to obtain

$$q^{(f,\mathrm{rank})}(t+1,\ s,\ h') = \sum_{h}^{H}\sum_{r=1}^{R} p_t^{(m)}(s,\ h'|r,\ h)[1 - p_{tr0}^{(f)}(h)]q^{(f,\mathrm{rank})}(t,\ r,\ h).$$

This would generate the survivor function for women if they experienced the same rank transitions as men throughout their careers in executive management and tell us whether women executives tend to gravitate to dead-end positions that are associated with higher rates of exit. We can also calculate the differential effect of initial conditions on women by replacing

Table 8
Dynamic Gender-Gap Decomposition

	Expected Career Length, T (1)	Average Career Wage, W/T (2)	Discounted Earnings (3)
Age 49:			
Male	4.8519	2,195,200	7,606,800
Female	3.0901	2,106,100	5,303,700
Female with male initial assignment (q_0)[a]	3.0524	2,240,700	5,494,000
Female with male job transition ($p_r s$)[b]	3.0887	2,171,600	5,415,700
Female with male exit rates ($p_r 0$)[c]	4.5186	2,061,400	6,907,800
Female with male initial rank assignment[d]	3.2660	2,296,800	6,028,800
Female with male career distribution[e]	4.8519	2,298,500	8,092,300
Age 39:			
Male	4.9251	1,931,400	6,395,200
Female	3.1381	1,820,900	4,540,800
Female with male initial assignment (q_0)[a]	3.0495	1,897,300	4,534,500
Female with male job transition ($p_r s$)[b]	3.1853	1,876,800	4,672,200
Female with male exit rates ($p_r 0$)[c]	4.5752	1,890,000	6,146,000
Female with male initial rank assignment[d]	3.2653	1,875,800	4,790,100
Female with male career distribution[e]	4.9251	2,034,400	6,862,000

[a] Counterfactual if women changed in just one respect, by following the initial rank and human capital distribution of men.
[b] Counterfactual if women changed in just one respect, by following the ‘transition pattern of men.
[c] Counterfactual if women changed in just one respect, by following the exit behavior of men.
[d] Counterfactual if women changed in just one respect, by following the initial rank distribution of men.
[e] Counterfactual if women followed the career distribution of men but retained the wage function of women.

$q^{(f)}(t_0, r, h)$ with $q^{(m)}(t_0, r, h)$ and $q^{(f)}(t, r, h)$ with $q^{(f,\text{initial})}(t, r, h)$ in equation (2), defined in an analogous way. Since there are fewer female executives than male executives, there may be greater selectivity into the sample by those women who are less likely to leave the sample population, suggesting that the aggregate rate of female exit in some sense understates the underlying process.

As an empirical matter, gender differences in the rank transition probabilities and initial conditions affect the differences in the survivor functions only minimally. Replacing $p_t^{(f)}(s, h'|r, h)$ with $p_t^{(m)}(s, h'|r, h)$ and $q^{(f)}(t, r, h)$ with $q^{(f,\text{rank})}(t, r, h)$ in equation (2) yields the survivor function for women if they experienced the same rank transitions as men throughout their careers in executive management. Similarly, we calculated the differential effect of initial conditions on women by replacing $q^{(f)}(t_0, r, h)$

with $q^{(m)}(t_0, r, h)$ and $q^{(f)}(t, r, h)$ with $q^{(f,\text{initial})}(t, r, h)$ in equation (2). The initial conditions are the composite of the initial rank assignment and the initial level of human capital. Let $q^{(f,r\text{initial})}(t, r, h)$ denote the counterfactual survival probabilities if women changed in just one respect, by following the initial rank assignment of men. The differential effect of initial rank assignment on women is calculated by replacing $q^{(f)}(t_0, r, h)$ with $q^{(m)}(t_0, r, h^f)$ and $q^{(f)}(t, r, h)$ with $q^{(f,r\text{initial})}(t, r, h)$ in equation (2), where $q^{(m)}(t_0, r, h^f)$ is the joint probability that a female executive at age t_0 holds the rank of her male counterpart but the experience of a female executive. In all cases, the shift in the survivor function is barely visible at this level of resolution. From table 8, swapping the initial conditions, or changing the transition probability, increases the expected career length for female executives in the panel at ages 39 and 49 by less than a month. In summary, the direct effect of exit rate explains most of the difference in career length of female and male executive managers.

C. Is There a Glass Ceiling?

With estimates of $q^{(g)}(t, r, h)$, we can now answer whether women executives are less likely than men to achieve the pinnacle of executive management and, if so, why. The probability that an executive in the population at t_0 with gender $g \in \{f, m\}$ is a CEO (in rank 2) at age $t \geq t_0$ is

$$q^{(g)}(t, 2) = \sum_{h=1}^{H} q^{(g)}(t, 2, h). \tag{7}$$

Figure 3*A* shows that executives in the sample at age 49 are more than twice as likely to be a CEO than an executive in the sample 10 years younger, reflecting our life cycle approach to the definition of a career hierarchy. Female executives in the population at either age are less than half as likely to be CEOs as are men.

What explains these gender differences? Are women promoted within the firm more slowly and less likely to accept attractive offers from other firms? We replace set $q^{(f)}(t, 2, h)$ by $q^{(f,\text{rank})}(t, 2, h)$ in equation (7) and check how much the probability of being a CEO increased when women transitioned through the ranks following the same transition matrix as men. Figure 3 shows that the effect of this counterfactual is small (see also the last four panels of table A4). In other words, the gender differential in the probability of being a CEO is primarily due to differences in the other two factors, exit rate and initial conditions.

Replacing $q^{(f)}(t, 2, h)$ by $q^{(f,\text{initial})}(t, 2, h)$ in equation (7) yields the probability of a woman executive at age t_0 being a CEO at age t if she had been assigned the initial endowment of men. By construction, the probability at t_0 is equal, but it quickly falls off, partly because of the differen-

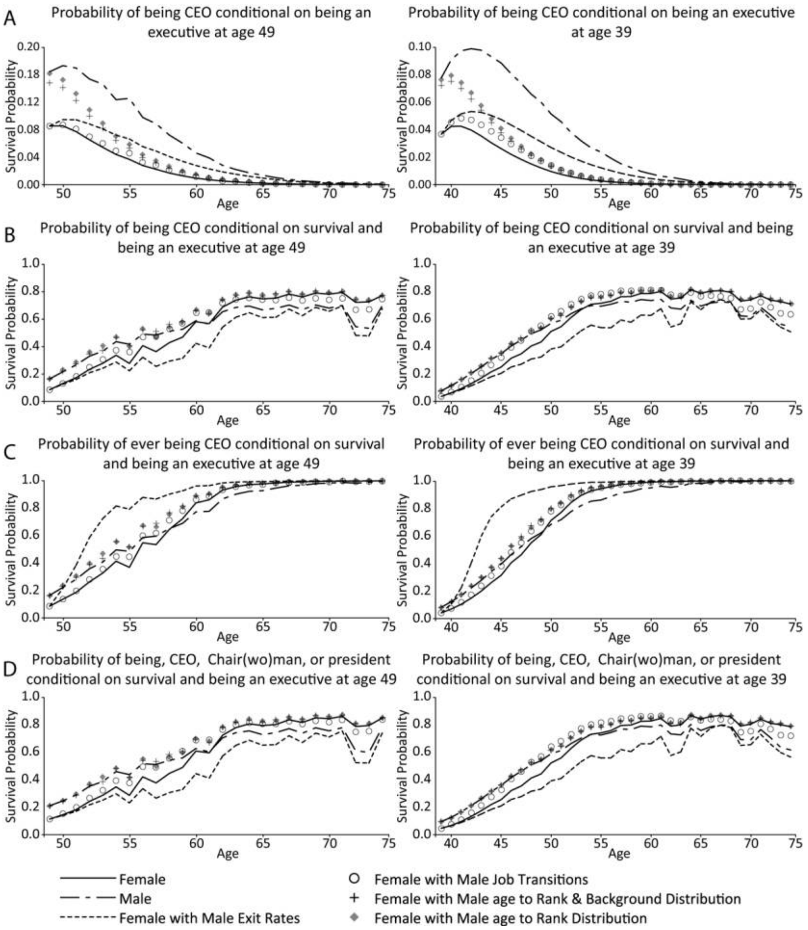

FIG. 3.—Probabilities of being chief executive officer (CEO), chair(wo)man, or president. Color version available as an online enhancement.

tial exit rates. Breaking things down further, we investigated to what extent their initial assignment, conditional on their past experience, is a determining factor, versus the different background they have at the time. We found that only the initial rank counts, not initial differences in executive experience, industry background, or education. Replacing $q^{(f)}(t, 2, h)$ by $q^{(f, r\text{initial})}(t, 2, h)$ in equation (7) produces a line in figure 3 that practically overlays the $q^{(f,\text{initial})}(t, 2)$ line.

The higher rate of female exit shrinks the pool of female candidates eligible to be CEO, thus contributing to the gender differences. If female exit patterns mimicked those of their male colleagues, would the sequence of probabilities close the gap? Upon replacing $q^{(f)}(t, 2, h)$ by $q^{(f,\text{exit})}(t, 2, h)$

in equation (7), figure 3 shows that the sequence of probabilities would increase but not close the gap. Thus, both initial conditions and exit rate are important explanatory factors for why women are less likely than men to make CEO.

We can eliminate the effects of exit rate and mitigate through the passage of time the effects of the initial conditions, by analyzing the pool of survivors. The probability of being a CEO with gender g at age t conditional on belonging to the population at age t_0 and remaining in it until at least age t is

$$q^{(g)}(t,\ 2) = \frac{\sum_{h=1}^{H} q^{(g)}(t,\ 2,\ h)}{\sum_{r=1}^{R}\sum_{h=1}^{H} q^{(g)}(t,\ r,\ h)}. \tag{8}$$

Figure 3B (and the third panel in table A4) has two notable features that characterize both age groups. Conditional on survival, the probability of being a CEO increases for more than a decade, rising to and then remaining above one-half for a further 10 years (and longer for the younger group). More remarkably, among those who survive longer than 15 years, a woman invariably has a higher probability of being a CEO than does a man. This finding contradicts the common belief that women face glass ceilings.

There are, of course, alternative definitions of top management, and we investigated whether our conclusions are sensitive to them. In our career hierarchy, chairmen who are not also officers directly under the CEO (e.g., the chief financial officer and the chief operating officer) are classified in rank 1. Rather than focus on expression (7) only, we also experimented with a more inclusive definition of top executive position by combining the two top ranks and recomputing the comparable panels of figure 3B. The probability of being in the two top ranks with gender g at age t conditional on belonging to the population at age t_0 and surviving until age t at least is

$$q^{(g)}(t,\ 2) + q^{(g)}(t,\ 1) = \frac{\sum_{r=1}^{2}\sum_{h=1}^{H} q^{(g)}(t,\ r,\ h)}{\sum_{r=1}^{R}\sum_{h=1}^{H} q^{(g)}(t,\ r,\ h)}.$$

There is little to distinguish between figures 3B and 3D, which depict our estimates of $q^{(g)}(t,\ 2) + q^{(g)}(t,\ 1)$. Using either definition of top management, our results provide scant support for the view that female executives in publicly listed companies face glass ceilings.

An alternative approach to measuring female representation at the highest levels of management is to compute, by gender, the fraction of executives who pass through the rank of CEO before exiting. Denote by $q^{(\text{CEO},g)}(t,\ 2)$ the number of executives who were in the sample at age $t_0 \in$

{39, 49} and had at least 1 year of CEO experience by age t as a fraction of the sum of this number plus executives who are still waiting for the job of CEO, having neither quit the sample by age t nor made CEO. Within our framework, this counterfactual is equivalent to treating the CEO rank as an absorbing state, thus eliminating CEO exit, leaving the other exit probabilities unchanged, and assuming that an executive attaining the rank of CEO never changes rank again.[6] Thus,

$$q^{(\mathrm{CEO},g)}(t+1,\ s,\ h') = \sum_{h}^{H}\sum_{r=1}^{R} p_t^{(\mathrm{CEO},g)}(s,\ h'|r,\ h) \times [1 - p_{tr0}^{(\mathrm{CEO},g)}(h)]q^{(\mathrm{CEO},g)}(t,\ r,\ h),$$

and

$$q^{(\mathrm{CEO},g)}(t,\ 2) = \frac{\sum_{h=1}^{H} q^{(\mathrm{CEO},g)}(t,\ 2,\ h)}{\sum_{r=1}^{R}\sum_{h=1}^{H} q^{(\mathrm{CEO},g)}(t,\ r,\ h)}.$$

From figure 3C (or the fourth panel of table A4), we see that the crossover occurs earlier than in figure 3B, thus validating our finding: among survivors, women have a higher probability of reaching the position of CEO than do men. The fact that their crossover age is about 2 years younger indicates that their tenure as a CEO is also a little lower, partly attributable to their higher rate of exit.

D. Lifetime Compensation

Although female executives are paid more than male executives for a specific experience vector at any given rank and have a higher probability of attaining the position of CEO than do male executives conditional on remaining in top management, they exit more than men from these very senior positions. This reduces the net present value of their lifetime earnings in this occupation. In this section, we decompose the gender compensation gap into the amount due to differential occupation exit rates, rank transition probability, and initial conditions. In this part of the study, we focus on two measures of lifetime earnings. The first measure is the sum of discounted expected earnings from executive management:

$$V_{t_0}^{(g)} \equiv \sum_{t=t_0}^{\infty}\sum_{r=1}^{R}\sum_{h=1}^{H} \beta^{t-t_0} w_{tr}^{(g)}(h) q^{(g)}(t,\ r,\ h), \tag{9}$$

[6] Mathematically, we set $p_{t20}^{(\mathrm{CEO},g)}(h) = 0$, leave $p_{tr0}^{(\mathrm{CEO},g)}(h) = p_{tr0}^{(g)}(h)$ for all $r \neq 2$, and set $p_t^{(\mathrm{CEO},g)}(2,\ h'|2,\ h) = 1$, which implies $p_t^{(\mathrm{CEO},g)}(s,\ h') = 0$ for all $s \neq 2$.

where β is the subjective discount factor. The second measure we use is average annual career wages, which corresponds to the steady-state cross-sectional average earnings. Average annual career earnings can be expressed as the ratio $W_{t_0}^{(g)}/T_{t_0}^{(g)}$, where $W_{t_0}^{(f)}$ is just equation (5)–defined t_0-year-old female executives, averaged over their experience and ranks.

Integrating the estimates obtained from the compensation regressions reported in table 4 to obtain $w_{tr}(h)$, we calculated estimates of average career wage over that time, $W_{t_0}^{(f)}/T_{t_0}^{(f)}$, and expected a discounted sum of compensation $V_{t_0}^{(f)}$ from age t_0 onward, as well as the analogous quantities for men, setting the discount factor to $\beta = 0.9$. Then, we computed counterfactuals for these numbers by endowing female executives with some of the factors that determine the executive careers of men.

The top entries in each panel of table 8, column 2, imply that the estimated gender gap in (undiscounted) annual compensation for executives at ages 39 and 49 averaged over the remainder of their management career is about \$100,000. Given the longer career horizon of men, at a 10% discount factor this translates to a present value of about \$2 million, which can be deduced from column 3. The gender gap in these career measures of executive compensation is not attributable to unequal pay for equal work. Our compensation regressions, reported in table 3, showed that at any given rank women are paid more for the same experience credentials. Substituting $q^{(m)}(t, r, h)$ for $q^{(f)}(t, r, h)$ in equations (5) and (9) for $t_0 \in \{39, 49\}$, we find that the men would benefit about \$100,000 per year on average from receiving the compensation package of women, all else the same, which translates to about \$400,000 in present value terms over their careers as executives, numbers that follow from differencing the top from the bottom numbers in table 8, columns 2 and 3.

We investigated the effect of assigning the initial male distribution of ranks to female executives, substituting $q^{(f,\text{initial})}(t, r, h)$ for $q^{(f)}(t, r, h)$ in equations (5) and (9) and computing $W_{t_0}^{(\text{initial})}/T_{t_0}^{(\text{initial})}$ and $V_{t_0}^{(\text{initial})}$. Table 8 shows that the initial assignment has greater impact (rising by \$134,600 for the older group, \$76,400 for the younger) than the transition probability computed in a similar fashion (where the numbers are \$65,500 and \$55,900, respectively). Most of the effect from switching the initial endowments comes from switching the initial rank alone, obtained by computing $W_{t_0}^{(r\text{initial})}/T_{t_0}^{(r\text{initial})}$ and $V_{t_0}^{(r\text{initial})}$. Indeed, giving 49-year-old female executives the distribution of male initial experience actually reduces their average annual earnings throughout their career. Note that because these changes hardly affect the survivor function, the effect on discounted career earnings is attenuated.

Giving female executives the same exit rates as male executives significantly lengthens their expected durations and, for that reason alone, generates higher expected discounted sums. To determine the effect of imposing male exit rates on women, we substituted $q^{(f,\text{exit})}(t, r, h)$ for

$q^{(f)}(t, r, h)$ in equations (5) and (9) and computed $W_{t_0}^{(\text{exit})}/T_{t_0}^{(\text{exit})}$. The gender gap for discounted earnings over the remaining career declines substantially from $2.3 million to $699,000 for 49-year-old executives and even more for 39-year-old executives, from $1.85 million to $249,000. However, the evidence from annual average career compensation is inconclusive. If 39-year-old female executives substituted male exit behavior for their own, then their annual compensation would rise by $69,100 per year, but for 49-year-old executives, compensation would actually fall by $44,800.

In identifying the most important factors driving the average annual gender compensation gap, we should distinguish between the two age groups. Focusing first on the 49-year-olds in table 8, we see that if female executives had been assigned the initial rank distribution for men, their average career wage, $2,296,800, would have surpassed the corresponding figure for men ($2,195,200) by about $100,000. The remaining factors—gender differences in exit rates, job transitions, and the initial distribution of experience—collectively accounted for less than $2,000 per year of the differential between what women and men would earn if they received female compensation awards. Thus, for the older group, the initial distribution of ranks fully accounts for the pay gap between men and women. This result contrasts with our findings for the younger group of executives, where switching the exit rate plays a much greater role in closing the gap between female average earnings and the hypothetical earnings men would make from receiving female wages. The effect on total earnings from spending an average of an extra 18 months in executive management is therefore more pronounced at 39 than at 49.

Table 8 (and also table A4) shows that the gender differences in compensation, expected career length, and the probability of becoming a CEO are almost entirely accounted for by differences in exit rates, transitions rates, and initial conditions. It presents a summary measure of all the other components of the decomposition; it combines the per period compensation, expected career length, and rank distribution into one measure, expected lifetime compensation. It shows that the gender differences are more pronounced at age 49 than at age 39. At 49 the gaps are accounted for by gender differences in the distributions of rank and experience at that age and the exit and job-transition rates thereafter. At 39 the gaps are accounted for by the gender differences in exit and job-transition rates. However, the gender differences in the distributions of experience and rank at age 39 are not important.

The differences between the distributions of rank and experience at ages 39 and 49 are due to a combination of exit and job-transition rates during that time. This means that gender differences in exit and job-transition rates are more important in explaining the gender differences in career outcomes than gender differences in the distributions of rank and experience at age 39. Extrapolating, perhaps the differences in exit and job-transition rates before age 39 account for the gender differences observed at age 39.

V. Discussion and Conclusion

Our empirical analysis shows that female executives have different backgrounds and experience from male executives and that women are paid more and have higher pay-for-performance sensitivity than men conditional on rank, background, and experience. We also find that women are promoted more quickly internally; however, women display similar rates of external promotion to men and have comparable demotion rates. Because female executives have a higher rate of promotion at the upper levels of the hierarchy, they have significantly less job experience than male executives. Female executives, however, have a higher exit rate than men, and the probability of a female executive becoming CEO is less than half that of male executives at every age. Our decomposition shows that the male executives' survival rate is twice that of female executives. The gender differences in career length are fully accounted for by the difference in exit rates, and, conditional on survival as an executive at any age, women have a higher probability of becoming a CEO. The average career compensation of female executives is lower than that of male executives, but it is higher than male executives' if female executives are assigned the male initial experience, the male initial rank assignment, or the male career experience distribution.

Suppose executives have concave utility over consumption and there are no gender differences in preferences and unobserved ability. Suppose that lower-level ranks provide more opportunities for investment in human capital and that a longer tenure and experience in these ranks increases the productivity of executives more than tenure and experience in higher ranks. If women have an exogenously higher nonmarket outside option than men, then a model of moral hazard, investment in human capital, and career concerns can account for most of the above findings (see Gayle, Golan, and Miller 2011).

An exogenously higher nonmarket outside option implies that women at all ranks and experience levels would exit at a higher rate than men. A higher female exit rate has two separate effects; the first is that female executives would gravitate to higher ranks and spend less time investing in human capital. This would explain the higher female promotion rate, the lower human capital of female in higher ranks, and the unconditional gender pay gap. The second effect is that female executives would have less incentive to exert effort than male executives because, on average, their careers are shorter. Since their career concerns motive is weaker, females require more incentive pay than their male counterparts to align their incentives with those of their employer firms. Therefore, their compensation is tied more closely to the firm's performance, with a higher risk premium.

Suppose that expected compensation reflects an executive's marginal product, that marginal product is equalized across genders, and that females are paid the same expected compensation as their male counterparts. Equalizing expected compensation with a higher risk premium implies a lower-certainty equivalent compensation. Being paid a lower-certainty equivalent compensation makes a job even less attractive to females and thus amplifies the higher female quit rate. These explanations appear consistent with our findings.

There is still a question of why women find the nonmarket outside option more attractive than do men. One explanation is that women acquire more nonmarket human capital than do men throughout their lives and, hence, find retirement a relatively attractive option. Women in the top executive market are mostly beyond childbearing age, but there is evidence that such women are more likely to leave for personal and other household reasons than are their male counterparts. For example, Sicherman (1996) finds that in a case study of a large insurance company, female executives were more likely than their male counterparts to exit the firm because of better working conditions elsewhere, a desire to be near home, a change of residence, household duties, personal heath, illness in the family, and positions being abolished. Most of those reasons, except positions being abolished, are voluntary departures related to home or family. Other unobserved factors leading managers to exit could include more unpleasantness, indignities, and tougher unrewarding assignments at work, examples of factors that reduce the attraction of work without necessarily affecting productivity or human-capital acquisition. Perhaps women are subject to this form of gender discrimination.

Another possible explanation for the higher female exit rates is differential treatment of men and women with the same expected ability in this market. Perhaps there is more uncertainty about women's skills when they enter the sample (see Lundberg and Startz 1983); this hypothesis is supported by the fact that when women enter, they are younger, have less experience, and have fewer qualifications than men. The hypothesis that there is more uncertainty about women's ability is consistent with the fact that women are more likely to exit and that those who remain are more likely to get promoted and earn higher wages as more information about their ability is revealed over time. Suppose that bad performance provides a signal on an executive's ability. If firms have more uncertainty about women's ability than men, then the relationship between firm performance and the rate of exit should differ by gender. However, we do not find any differences on that score.

A more complex model of promotions and uncertainty about abilities is developed in Scotchmer (2008); it assumes no gender differences in abilities but that men take more risk and therefore provide less accurate information on their abilities than do women. In Scotchmer's model, men are more likely than women to survive and get promoted more at early ages, and male survivors have lower average ability than females. At older ages, these roles are reversed; females are promoted more, and their average ability is lower than male survivors'. In our sample, we do find that males are more likely to survive at lower ranks than females; however, females are promoted more quickly than males at all ranks and ages.

Another type of discrimination is suggested by Milgrom and Oster (1987). In their model, abilities of executives are known to employers, but initially males are more visible to outside employers than are females, allowing employers to extract more rents from female executives. Promotions enhance visibility of workers to outside employers; this increases competition for female executives, which in turn increases their compensation and reduces the employers' rents. Their model implies that female executives would face a higher threshold for promotion than their male counterparts. Further, it implies that the gender compensation gap in higher ranks should be smaller than the gap in lower ranks. We find that male and female executives are paid the same, conditional on rank alone. Conditional on background characteristics and job experience, female executives are paid more than their male counterparts at all ranks. Moreover, we do not find differences in external promotion rates between males and females, which might be expected if women were less visible than men.

Our analysis cannot rule out discrimination based on unobserved factors. However, whatever the mix of the explanations above, we do not find any clear evidence that aggregate differences observed in the executive market between genders are driven by compensation packages and promotion opportunities available to men and women. It is possible that discrimination explains, at least partially, the small fraction of women, compared to men, who join the ranks of executive management in publicly listed firms. We are unable to address this issue because our data set comprises only those who reach these positions, but our analysis identifies one reason for the relative scarcity of female executives. Women executive managers are more likely to exit than men, spending less time in those positions than male executives do on average.

In principle, a large longitudinal data set might be assembled to track men and women from an early age, in order to distinguish by gender the contribution of background variables of those who attain the position of executive manager from those who do not. The results of our study highlight two challenges that such an approach must overcome to yield convincing results. We have established that executive managers are not drawn from an easily identified population. Because they are drawn from very diverse backgrounds, because executive managers comprise a minute portion of the general population, and because women are less than onetenth as likely to be executive managers than are men, a very large sample is required to obtain meaningful results that separate by gender those who become executive managers from those who do not. A second challenge proponents of a longitudinal approach would face stems from the fact that many executives enter the market after a long period of acquiring education and other work experience, requiring a longitudinal study to track respondents for more than 20 consecutive years, resulting in an expensive long-term research project susceptible to choice-based attrition bias. In the meantime, we hope that our results will encourage future research on gender differences in executive management to turn away from compensation and promotion and toward the nonpecuniary characteristics of executive management jobs and options outside the marketplace.

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