Female Executives and the Motherhood Penalty

Seth Murray*
Federal Reserve Board

Danielle H. Sandler†
U.S. Census Bureau

Matthew Staiger‡
University of Maryland

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Abstract

We use U.S. linked survey and administrative data to investigate whether the sex composition of a firm's executives affect the earnings and employment outcomes of new mothers. Our empirical strategy compares the earnings trajectories of new mothers to other similar women who are employed at the same firm but who did not give birth around that time. On average, mothers earn almost $2,000 less per quarter two years after birth but we find that the magnitude of these losses is unrelated to the female share of executives at the mothers' employer. We provide evidence that our conclusions are not affected by nonrandom sorting of workers into firms by replicating our results within more homogeneous subsamples defined by worker and firm characteristics as well as using an empirical strategy that compares the earnings losses of mothers within firms before and after changes in the executives.

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*E-mail: seth.m.murray@frb.gov
†E-mail: danielle.h.sandler@census.gov
‡E-mail: mstaiger@umd.edu.

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1 Introduction

Although the male–female earnings gap has decreased over time, in recent decades that decrease has slowed and the average earnings of women remains at approximately 80% of men's earnings in the United States.[1] Childbirth and subsequent breaks from the labor market play an important role in determining this gap.[2] However, the labor market consequences of having a child differ drastically across mothers.[3] While some of the variation across mothers is likely attributable to differences in individual preferences and government policies, firm-level factors may play a role as well. In this paper we investigate the effect of the sex composition of a firm's executives, as defined by top earners within the firm, on the earnings and employment outcomes of female employees after childbirth.

The expected effect of the sex composition of executives on the labor market outcomes of new mothers is ambiguous based on the previous literature. On the one hand, research finds that the outcomes of new mothers vary across firms (Hotz et al., 2017), which is consistent with a broader literature that establishes the importance of the match between the worker and the firm in determining male-female earnings differentials (Manning, 2011; Card et al., 2018). Furthermore, studies have shown that work-related policies, such as expanded access to childcare, can meaningfully reduce the child penalty (Nix and Andresen, 2019; Kleven et al., 2020; Bächmann et al., 2020). On the other hand, research that investigates the link between the representation of women in leadership positions and disparities in labor market outcomes between male and female employees generally finds mixed evidence. Kurtulus and Tomaskovic-Devey (2012) and Bhide (2019) find that female leadership decreases employment and earnings disparities between men and women, although this may dispro-

[1]This male-female earnings gap is based on full-time wage and salary workers. Source: U.S. Bureau of Labor Statistics (2020)

[2]The negative effects of having a child on women's earnings and employment outcomes has been documented in many countries including Sweden (Angelov et al., 2016; Albrecht et al., 2018), Denmark (Kleven et al., 2019a), Norway (Bütikofer et al., 2018; Nix and Andresen, 2019), the United Kingdom (Kuziemko et al., 2018), and the United States (Hotchkiss et al., 2017; Neumeier et al., 2018; Sandler and Szembrot, 2019).

[3]Kleven et al. (2019b) make comparisons across several different countries and find that Sweden and Denmark have the smallest motherhood penalties, the United States and United Kingdom larger, and Germany and Austria have the largest motherhood penalties.

portionately benefit women at the top of the wage distribution (Flabbi et al., 2019), and does not necessarily operate through the adoption of family-friendly policies (Bhide, 2019). Abendroth et al. (2017) and Cullen and Perez-Truglia (2019) find that while men benefit from having male managers, female managers promote and compensate men and women equally.

We shed new light on these issues using linked survey and administrative data from the United States. We use survey data from the 2000 and 2010 Decennial Censuses as well as the 2001-2017 American Community Surveys (ACS) in order to identify birthdates of the children of women in our sample. We link these survey records to administrative employer-employee linked data from the Longitudinal Employer-Household Dynamics (LEHD) dataset, which measures quarterly earnings of individuals as well as characteristics of their employers. Our preferred definition of an executive–which we validate using occupation data from the ACS–is an individual who is among the top three earners at the employer.

We begin by documenting a number of motivating descriptive statistics. First, we show that the motherhood penalty is responsible for a major part of the male-female earnings gap. The male-female earnings gap drastically increases between the ages of 20 and 35, which are the primary ages in which women have children, reaching a maximum of nearly -60 log points.[4] Controlling for the birth of a child, however, reduces this male-female earnings gap by about two thirds. In addition, we show that the male-female earnings gap is smaller in industries in which a larger share of executives are women and that the male-female earnings gap has declined more in industries that have experienced a greater increase in the share of executives that are female.

Motivated by these descriptive patterns, we investigate whether the sex composition of leadership at a woman's employer affects the magnitude of her earnings losses when she has a child. Our primary empirical strategy estimates the motherhood penalty by comparing new

[4]Our estimates do not condition on full-time employment. For this reason, our estimates of the male-female earnings gap are larger than other estimates that condition on full-time employment (U.S. Bureau of Labor Statistics, 2020).

mothers to observably similar female coworkers who did not give birth around the same time. We examine whether this motherhood penalty differs by the number of women in executive positions at the employer. Specifically, we estimate a matched event study specification on panel data in which the dependent variable is quarterly earnings and the primary independent variables include a set of dummy indicators for i) time since birth, ii) whether the individual is a mother, and iii) the number of executives (top three earners) that are female. The specifications also include individual fixed effects and quarter-by-coworker-pair fixed effects, as well as a set of flexible controls for age interacted with education.

We find no evidence that the earnings losses associated with having a child are related to number of executives that are female at the mother's employer. On average, new mothers experience an earnings loss of about $3,000 in the quarter after birth, which slightly recovers to a decline in quarterly earnings of about $2,000 two years after the birth. These magnitudes are virtually identical regardless of the number of female executives at the employer.

The fact that workers and executives are not randomly assigned to employers raises two main reasons why our estimates might not identify the causal effect of the sex composition of the executives on the earnings losses of new mothers. First, the earnings losses of new mothers may by determined by individual-level heterogeneity that is correlated with with the sex composition of the executives. For example, women who choose to take longer breaks from work after the birth of a child may tend to sort into more family-friendly firms that have greater representation of women in leadership positions. Second, there may be factors that are correlated with the share of executives that are female and also have an independent effect on the labor market outcomes of new mothers. For example, firms that have strong policies in place to address disparities between men and women may be more likely to retain and promote women as well as foster policies that reduce the career costs of having a child. We explore the importance of these issues in two ways.

First, our finding that the number of female executives is unrelated to the labor market outcomes of new mothers holds within more homogeneous subsamples defined by both worker

and employer characteristics. Specifically, we find a similar lack of relationship when looking within subsamples defined by worker characteristics such as pre-birth earnings, birth order, race/ethnicity, and education. This provides evidence against the possibility that individual-level heterogeneity is a confounding factor. Our findings are also robust within subsamples defined by employer size and to using an alternative measure of executives that focuses on the top earner at the employer and to estimating effects separately for female top-earners that are and are not themselves mothers. These latter results provide some evidence that our findings are not driven by measurement error in identifying the executive.

Second, the lack of relationship is also robust to using an alternative empirical strategy that compares the outcomes of new mothers within employers before and after changes in the executives at the employer. We identify executive transition events in which the stable top earner at the employer (i.e., an individual who is consistently a top earner at the employer) changes. We then estimate the motherhood penalty for women who give birth before versus after the executive transition event — asking whether the motherhood penalty is different for women who give birth when the employer's top earner is female. Using this strategy we continue to find no evidence that the earnings losses associated with childbirth are affected by the representation of women in top positions within the employer. These results suggest that time-invariant characteristics of the employer are not a confounding factor.

Taken together, the robustness of our findings within subsamples and to the alternative empirical strategy, rules out the most obvious explanations for how the nonrandom assignment of workers and executives to employers could affect our estimates. In this way, our results suggest that the number of female executives does not have a causal effect on the earnings penalty that women experience when they have a child.

The paper proceeds as follows. Section 2 describes the data. Section 3 presents descriptive evidence that relates the male-female pay gap to childbirth and female representation in the executives. Section 4 explores the relationship between the number of female executives and the earnings penalties that women experience after having a child. Section 5 concludes.

2 Data and Measurement

2.1 Measuring Childbirth Histories

We combine survey data from the 2001-2017 American Community Survey (ACS) with data from the 2000 and 2010 Decennial Censuses in order to identify the timing of births. The survey data indicate both i) the relationship between each household member and the head of household at the time of the survey, and ii) the date of birth of each household member. In principle, the 2000 and 2010 Decennial Censuses include all individuals living in the United States in 2000 and 2010, respectively. Given that the Censuses only provide snapshots of the households as of 2000 and 2010, we use the ACS to expand the coverage (most importantly from 2011-2017). From 2005 forward, approximately 2 million households responded to the ACS each year (with an additional 600,000 respondents each year from 2001-2004).

We identify a history of births for each parent using the following methodology. In each survey (Decennial Censuses and ACS surveys) we retain a sample of household heads and their spouses (dropping same sex couples, as we are unable to accurately identify the biological mother for this group). We then drop individuals if we are unable to link them to administrative data on labor market outcomes.[5] We identify all individuals defined as biological children of the head of household and merge these children to the parent-level file. By using the date of birth of each child, we create a dataset for each survey in which the unit of observation is the parent by quarter of birth of a child (twins are included but appear as a single observation). We then combine all sources of data, taking the union of all parent-birth events and retaining a record of which survey the observation appeared in.

While these data provide a reasonable way to measure the timing of the birth of the children of many parents throughout the United States, there are a few key limitations.

[5]Individuals are identified by the Protected Identification Key (PIK), a Census-specific identifier that probabilistically matches records using personally identifiable information. The PIK links person records between the survey and administrative files and we require that the parents are successfully assigned a PIK. Previous work that uses the ACS and Decennial files finds that about 90% of individuals are assigned a PIK (Wagner and Lane, 2014).

First, if parents do not live with their children at the time of the survey, then the parent-child relationship will not be measured. We minimize the risk of such measurement error by combining all responses between 2000 and 2017. Furthermore, we are primarily concerned with measuring birth outcomes for mothers, who are more likely to stay with the child (relative to fathers) and thus are less subject to this type of measurement error.[6] Second, because all relationships are defined relative to the head of household, there will be some ambiguity with regards to the identity of the biological mother in instances in which the husband is the household head. This type of measurement error will lead us to incorrectly assign some births to women who are not the mothers of the household head's child, and may attenuate our estimates of the effect of childbirth on labor market outcomes. However, we are primarily interested in understanding how the sex composition of leadership at the mother's employer affects her outcomes. Thus, as long as this type of measurement error does not vary by the sex composition of leadership, it should not affect our main results.

2.2 Measuring Labor Market Outcomes

We link these data on childbirths with earnings records from the LEHD. The LEHD is an employer-employee linked dataset produced by the U.S. Census Bureau and is constructed from two core administrative datasets: i) unemployment insurance (UI) records, which provide job-level quarterly earnings records, and ii) the Quarterly Census of Employment and Wages, which provides establishment-level characteristics such as industry, size and geographic location.[7] Because the LEHD reports earnings information for each worker within a firm, we can measure the labor market outcomes of both the individual worker and all of their coworkers. Importantly, the LEHD also includes characteristics, such as sex, race, age,

[6] 4 of 5 children who lived with only one parent in 2018 lived with their mother (Grall, 2020).

[7] The earnings records in the LEHD capture roughly 96% of private non-farm wage and salary employment in the United States. The coverage varies by state, but most states began reporting in the 1990s and all states besides Massachusetts–which began reporting in 2010–were reporting by 2004. See Abowd et al. (2009) for a detailed description of the LEHD infrastructure files.

and education, of the worker and their coworkers (including the top earners at the firm).[8]

2.3 Identifying Executive Leadership at Firms

In order to estimate the effect of the sex composition of executive leadership at firms on the labor market outcomes of new mothers, we must identify the executives at each firm. Unfortunately, the LEHD does not indicate the occupation of individuals or the management structure of firms. As a result, we categorize individuals as being in executive leadership roles at a firm based on the relative earnings of workers within the firm. For most analyses in this paper, we categorize the top one or three earners at an establishment as the executive leadership of the establishment.[9] In some cases, we also consider alternative earnings-based thresholds such as the top 1%, 5% or 10% of full-quarter earners within the establishment.[10]

In order to evaluate how well these earnings-based thresholds identify individuals in leadership positions within firms, we link ACS survey respondents' reported occupation with the LEHD earnings records of the respondents and their coworkers at the time of the survey. Panel A of Table 1 shows the frequency, by sex, with which ACS survey respondents whose full-quarter earnings exceed one of our firm-specific "leadership" earnings thresholds report having an occupation that can be classified as i) Executive or Managerial, ii) Professional, or iii) Supervisory.[11] 50% of women and 64% of men who are among the top three earners within their employer reported having one of these leadership occupations. These rates are about three times higher compared to those for individuals whose earnings are below the

[8]The education data are derived from survey responses of individuals aged 25 and older to the 2000 Decennial Census and the ACS. Education is imputed for all other individuals.

[9]Earnings measured as full-quarter earnings, or earnings in quarters q where the person was observed with earnings at the same employer in quarters $q+1$ and $q-1$.

[10]For each earnings threshold, we exclude slightly different sets of small firms. Specifically, we exclude all firms below the following size thresholds: for the top earner: firms with fewer than 3 employees; for the top three earners: firms with fewer than 9 employees; for the 90^{th} percentile: firms with fewer than 20 employees; for the 95^{th} percentile: firms with fewer than 40 employees; and for the 99^{th} percentile: firms with fewer than 200 employees.

[11]We definite these three occupation classifications based on the following ACS occupation codes. Executive or Managerial includes ACS occupation codes: 001, 002, 003, 004, 005, 006, 010, 011, 012, 013, 014, 015, 016, 020, 021, 022, 023, 030, 031, 033, 034, 035, 036, 041, 042, and 043. Professional includes: 080, 130, 210, 301, and 306. And Supervisorory includes: 370, 371, 372, 373, 401, 420, 421, 430, 432, 470, 471, 500, 600, 620, 700, 770, and 900.

90^{th} percentile of earnings at their firm.

Given our interest in the role of female leaders in mitigating the earnings and employment losses of employees who become new mothers, it is also helpful to consider the frequency with which top earners at the typical worker's establishment reports having a leadership occupation. These frequencies are shown in Panel B of Table 1–which is similar to Panel A but weights ACS survey respondents by the number of employees at each respondent's establishment. Panel B indicates that over 2/3 of the top three earners at the employer of a typical worker report having a leadership occupation in the ACS (68% for female top 3 earners and 78% for male top 3 earners). These rates are about three times higher compared to those for individuals whose earnings are below the 90^{th} percentile of earnings at their firm. Relative to individuals whose earnings are below the 90^{th} percentile of earnings at their firm, these rates are five and four times higher for women and men, respectively.[12]

3 Labor Market Outcomes of Mothers

This section documents both the sizable role of childbirth and motherhood on the the male-female earnings gap and the evolution of this gap for women between the ages of 18-54. We show that i) there is a substantial male-female earnings gap even for women who do not have children, ii) the male-female earnings gap widens with each additional child, iii) the earnings gap between mothers and women without children is widest between the ages of 35-40, but persists even through age 54, and iv) childbirth penalties can account for approximately 2/3 of the motherhood earnings gap at age 40.

In order to document these empirical facts, we construct the near universe of men and women born in the United States between 1964 and 1970. We focus on these birth cohorts because the 2000 and 2010 Decennial Censuses allow us to identify whether and when women

[12]In Appendix Table A.1 we show for each leadership occupation the share of ACS survey respondents who are top 3 earners. We break this out by firm size and find that individuals reporting a leadership occupation are more likely to be top earners if they are at a smaller firm.

in these cohorts gave birth between the ages of 18-40.[13] We further augment the sample to include individuals who i) were no older than 36 years old at the time of the 2000 Decennial Census, ii) responded to the ACS between 2011-2017, and iii) were over the age of 40 when they responded to the ACS. Including these individuals expands the sample to include a subset of the individuals born in the U.S. between 1971 and 1977. From this sample, we exclude any men or women with five or more children. We then link all of the remaining individuals to their LEHD earnings records — which allows us to identify each individual's quarterly real earnings between the ages of 18 through 54.

In order to estimate the magnitude of the male-female earnings gap and the importance of childbirth, we estimate three related regression specifications where the outcome variable in each regression is an individual's log real full-quarter earnings (y_{it}). We estimate the dynamic effect of being female ($f_i = 1$) on an individual's earnings at each age between 18-54 (represented by the set of indicator variables d_{it}^a that equal 1 only when the individual is the given age in quarters). Thus, in our first specification, we estimate:

$$y_{it} = \sum_{a=18.0}^{54.0} \left(\theta^a + f_i \beta^a + X_i \omega^a \right) d_{it}^a + \alpha_t + \epsilon_{it} \tag{1}$$

where i) X_i is a set of control variables that indicate each individual's race and level of education (which, when interacted with the age-specific indicator variable d_{it}^a, control for age-specific effects of race and education), and ii) α_t is a time fixed-effect (which, in addition to controlling for business cycle effects on earnings, also helps account for the entry and exit of U.S. states into the LEHD data over time). The β^a coefficients in this first specification provide estimates of the male-female earnings gap at age a.

As shown by the solid red line in Figure 1(a), we find that the male-female earnings gap widens steadily until reaching nearly -60 log points in women's late thirties. Starting around

[13] Women in these birth cohorts would have been between the ages of 30-36 at the time of the 2000 Census and at least 40 years old at the time of the 2010 Census. Assuming that children remain in the household of their mother through age 18, by combining records across these Censuses we can determine whether women gave birth between the ages of 18-40.

age 45, the earnings gap begins to slowly shrink but remains over -50 log points at age 53. Our estimates of the male-female earnings gap are larger than has typically been found in the literature. Multiple factors play a role in our larger estimates of the gap. First, previous studies of the male-female earnings gap have tended to focus on full-time workers, whereas our estimates include both part-time and full-time workers.[14] Second, we do not control for the occupation or industry in which women work.[15] And third, the near-universe level of our data allow us to generate estimates of the earnings gap at each age between 18-54, whereas most studies of the male-female earnings gap use much smaller samples and thus can only generate an average male-female earnings gap across all ages.

The second specification allows us to disaggregate this age-specific earnings gap for all women into age-specific estimates of the male-female earnings gap based on the total number of children that a woman has before the age of 40. Specifically, we replace the female indicator variable, f_i, with a set of indicator variables that represent the number of children that the woman has before the age of 40. These child count indicator variables, c_i^m, equal 1 only if i) the individual is female, and ii) the woman has m children where $m \in [0, 4]$. Thus, the second specification we estimate is:

$$y_{it} = \sum_{a=18.0}^{54.0} \left(\theta^a + \sum_{m=0}^{4} c_i^m \beta^{a,m} + X_i \omega^a \right) d_{it}^a + \alpha_t + \epsilon_{it} \tag{2}$$

where the control variables are the same as in the first specification. The $\beta^{a,m}$ coefficients in this second specification provide distinct estimates of the age-specific male-female earnings gap for women who have zero, one, two, three, or four children before the age of 40.

Figure 1(a) shows that the widening of the male-female earnings gap in women's 20's

[14] Our estimates combine the effects of gaps in both the wages earned and hours worked for women versus men. Including the effect of hours worked is particularly relevant when considering the effects of childbirth since women bear a disproportionate share of child-rearing responsibilities (Parker and Wang, 2013).

[15] Many studies of the the earnings gap try to control for occupation and industry so as to better measure differences in the compensation received by women for the same quality and type of work (Foster et al., 2020). We elect not to control for industry or occupation (we do not observe occupation) because women's plans and decisions to have children may affect their choices regarding the occupations to pursue and the industries they work in.

and 30's occurs no matter whether and how many children the women have. Women who never have children before the age of 40, represented by the line of light-blue hash marks in Figure 1(a), still experience a male-female earnings gap of nearly -40 log points by their late thirties. The various dashed lines in Figure 1(a), show that the male-female earnings gap grows larger with every additional child that the women have.

One important caution in interpreting our estimates of the earnings gap by the number of children for women past the age of 40 is that we mis-classify some women as having fewer children than they actually have because we often cannot identify childbirths that occur after the age of 40. This mis-classification is evident in Figure 1(b), which displays the results from these same two regression specifications but using individuals' full-quarter employment status as the outcome variable instead of log full-quarter earnings. For all women with children, the female employment rate gap widens substantially in women's 20's and 30's — with the widest female employment rate gaps occurring at age 35. For women we classify as having no children, however, we find a widening of the employment rate gap starting around age 40, with the nadir of their employment rate occurring in these women's late 40's. It is likely that this late dip in employment is due to childbirths after the age of 40.

Since our second specification does not control for childbirth effects, the difference between the line for women with no children and any given line for women with m children can be considered as the combination of two effects: i) the selection effect generated by the unobserved characteristics of women who elect to work and have m children, and ii) the childbirth earnings penalties combined over the m childbirths.

Our third specification seeks to disentangle these selection effects from the childbirth effects. This third specification expands on our second specification by adding four sets of indicator control variables, $b_{it}^{n,q}$, one set for each childbirth. Each of these indicator variables controls for the dynamic effects of the n^{th} childbirth q quarters before or after the birth quarter, where q ranges from 4 quarters before through 18 years after the birth quarter (i.e. the $b_{it}^{n,q}$ variable equals 1 only if t is the q^{th} quarter after woman i's n^{th} childbirth). Thus,

this third specification is:

$$y_{it} = \sum_{a=18.0}^{54.0} \left(\theta^a + \sum_{m=0}^{4} c_i^m \beta^{a,m} + X_i \omega^a \right) d_{it}^a + \alpha_t + \sum_{n=1}^{4} \sum_{q=-4}^{72} b_{it}^{n,q} \gamma^{n,q} + \epsilon_{it} \tag{3}$$

In this third specification, the $\gamma^{n,q}$ coefficients are estimates of the dynamic effect of childbirth on the male-female earnings gap,[16] whereas the difference between the $\beta^{a,m} - \beta^{a,0}$ coefficients can be interpreted as capturing the dynamic selection effects of the unobserved characteristics of women with m children.

Figure 2 shows that the childbirth penalties account for approximately 2/3 of mothers' earnings gaps in their mid-to-late 30's (relative to women with no children). In women's 40's and early 50's, however, the role of childbirth diminishes as more women reenter the labor force once their children reach school age and the selection effects of unobservable characteristics tend to dominate. In each panel of Figure 2, the red solid line indicates the overall male-female earnings gap and the light blue dotted line indicates the male-female earnings gap for women who have no children before the age of 40. The dashed green line indicates the male-female earnings gap for women who have n children, whereas the orange dashed line indicates the male-female earnings gap for women with n children after controlling for childbirth effects. Thus, the shaded grey area can be considered as the effects of childbirth on the male-female earnings gap. Similarly, the role of unobserved selection effects for women with n children are represented by the distance between the light blue dotted line (for women with no children) and the dashed orange line (for women with n children after controlling for childbirth effects).

[16] Appendix Figure A.2 plots the quarterly evolution of the birth penalties for mothers' earnings and employment outcomes by child birth order.

4 Female Executives and the Motherhood Penalty

This section investigates the relationship between the sex composition of executives at the firm and the labor market outcomes of new mothers. Our analysis is motivated by two industry-level correlations, one in levels and the other in changes, between women's share of leadership positions within an industry and the ratio of women's earnings to those of men in the same industry. First, as shown in Figure 3(a), the average ratio of female-to-male full-quarter earnings within firms in a given 3-digit NAICS industry is closer to one (implying a smaller male-female earnings gap) in industries where women are a larger share of the top 3 earners at a firm. Second, Figure 3(b) shows that the female-to-male earnings ratio within an industry tended to rise more between 1995 and 2017 if the industry also experienced a larger increase in the female share of top 3 earners within firms in the industry between 1995 and 2017.[17]

Despite these strong industry-level correlations between female leadership and the ratio of women's to men's earnings, we find no evidence that having more women in leadership positions mitigates the declines in new mothers' earnings and employment that accompany childbirth. We start by showing that the earnings losses experienced by new mothers are not related to the share of executives that are female. This finding is descriptive, as there may be confounding factors related to the motherhood penalty and the share of executives that are female. However, we continue to find a lack of relationship both when looking within more homogeneous groups of workers and firms as well as when using an alternative empirical strategy that exploits changes in the executives at the firm. Thus, the evidence suggests that the sex composition of executives at the firm has no effect on the labor market outcomes of new mothers.

[17] As shown in Appendix Figure A.1, from 1990 to 2017 the share of top earners at firms who are women has grown by between 10-15 percentage points - no matter whether the "top earners" are defined as the very highest earner at the firm or as the top 10% of earners at the firm or one of our alternative earnings-based thresholds.

4.1 Empirical Strategy Using Coworker Comparison

We estimate the motherhood penalty by comparing new mothers to similar women who do not give birth around the same period and we document the relationship between the sex composition of executives at the firm and this motherhood penalty. Specifically, we estimate the following specification:

$$y_{it} = \alpha_i + \gamma_{c(i)t} + \phi X_{it} + \sum_{k=-6}^{8} \sum_{f=0}^{4} \beta^{f,k} D_{it}^{f,k} + \epsilon_{it} \tag{4}$$

where i is the individual; t is the quarter relative to birth (t=0 is the quarter of birth); y is quarterly earnings or an indicator equal to one if earnings are positive; α_i is an individual fixed effect; $\gamma_{c(i)t}$ is a quarter by coworker pair fixed effect; $D_{it}^{f,k}$ is an indicator equal to one if i is a mother, the quarter t is k quarters after birth, and f of the top three earners are female; X_{it} is a vector of covariates that includes the interaction between a quadratic in age and education; and ϵ_{it} is a regression residual that is clustered at the level of the coworker pair. The coworker and the number of top earners that are female corresponds to the employer of the mother one year prior to the birth of her child ($t = -4$). The data are a balanced panel, which include observations twelve quarters before and eight quarters after the quarter of birth.

We estimate equation 4 on a sample of mothers who are relatively attached to the labor market. Specifically, we require that new mothers: i) be between the ages of 18 and 45 when they give birth, ii) be full-quarter employed and have at least one year of tenure at the firms as of one year prior to the childbirth, and iii) have at least one full quarter of employment in the eight quarters following the birth. We drop from the sample women whose earnings are above the 90th percentile of the within-firm earnings distribution so as to exclude women in leadership positions from the sample. To ensure that we can measure labor market outcomes before and after the birth we require that the LEHD dataset covers employment in the employer's state continuously over the period from twelve quarters before to eight

quarters after the childbirth. Lastly, given that our empirical strategy compares each new mother to a similar coworker, we also require that there is at least one other female coworker at the firm who did not give birth in the five years surrounding the mother's childbirth. Unless stated otherwise, we base our analysis on a random 25% sample of all observations that meet the above criteria.

We identify similar female coworkers who are not mothers by using nearest neighbor matching. We start by creating a sample of all women who are employed at the same firm as a mother in our sample one year prior to the birth of the child and who meet the same set of restrictions based age, tenure and labor force attachment that we impose on the mothers. Next, we limit the sample to women who are not themselves recent or soon-to-be mothers by using the 2001-2017 ACS files as well as the 2000 and 2010 Decennial Census files. For each childbirth event that occurs in quarter t, we identify the set of female coworkers who appear in a survey at least five years after t and who did not have a child within five years of q. From the pool of coworkers that meet these restrictions, we use nearest neighbor matching to identify the most similar coworker for each mother. The nearest neighborhood is identified based on the Mahalanobis distance calculated using the following variables: average earnings in the eighth through fourth quarter prior to birth, earnings growth between two and one year prior to birth, tenure four quarters prior to the birth, age, race/ethnicity, and education.

The analysis sample includes 143,000 unique mother-birth events. Inclusive of coworkers this creates a balanced panel with approximately six million person quarter observations. Table 2 presents basic descriptive statistics for the sample of mothers broken out by the female share of the top 3 earners at the mothers' employers. On average, mothers are in their late 20's and are fairly attached to their employer prior to birth, with an average tenure exceeding 13 quarters. Women at employers with more female executives tend to have lower earnings, be less educated, and be younger.

Figure 4 presents the average outcomes of mothers and coworkers in the 12 quarters before and after the birth of their child separately for four groups defined by the number of

top three earners at the firm that are women. The outcome in Panel A is quarterly earnings and the outcome in Panel B is employment. There are three things to note. First, there are substantial differences in average pre-birth earnings across the four firm groups; mothers and coworkers at firms with more women in executive positions tend to earn less. Second, new mothers at all four firm groups experience similar declines in average earnings after the birth of a child. Third, while there are small differences in the average earnings of mothers and coworkers in the quarters prior to birth, the earnings trajectories appear to be parallel. Thus, with the inclusion of individual fixed effects, these results lend some credibility to our empirical estimates of the motherhood penalty.

4.2 Estimates Based on Coworker Comparison

Figure 5 presents the main estimates from equation 4 and shows that the average earnings losses experienced by new mothers are similar regardless of how many executives at the firm are female. Panel A illustrates that, regardless of the number of executives that are female, new mothers experience a drop in earnings by an average of $3,000 in the quarter after birth. The earnings of new mothers quickly recovers after the initial drop, but remains almost $2,000 lower two years after the birth of their child. Panel B presents estimates of the effect on employment and shows that while there is some evidence that mothers at firms with more female managers are more likely to have zero earnings in the quarter following birth, there are no differences in average outcomes in the second through eighth quarters after birth. Taken together, these results establish that there is little relationship between the sex composition of executives at the firm and the female earnings penalties associated with having a child.

One potential issue apparent from the descriptive statistics in Figure 4 is that women who work at employers with more female executives tend to earn less prior to having a child. We estimate our specification on four distinct subsamples defined by the quartile of average quarterly earnings measured in the three years prior to birth. Figure 6 presents these

estimates. In general, the earnings losses following birth are larger for women with higher earnings prior to birth. However, within each category we continue to find no relationship between the earnings losses and sex of composition of the executives.

Another complicating factor is that many women have more than one child, and thus the pre- and post-birth estimates might be affected by the earnings consequences associated with prior or subsequent births. To assess this concern, we estimate our main specification on four subsamples defined by birth order: first child, second child, third child and last child. The results are presented in Figure 7. There are two things to note. First, within each subsample, we continue to find no relationship between the number of executives that are female and the earnings losses of new mothers. Second, the long-term (measured as two years after birth) earnings losses are larger for the first and second child, in part because these earnings losses also conflate the losses associated with subsequent births that occur within the window of analysis.

While we find no relationship between the earnings losses of new mothers and the sex composition of leadership at the firm, it is possible that confounding factors complicate the interpretation of these results. Specifically, the fact that workers and executives are not randomly assigned to employers raises two main reasons why our estimates might not identify the causal effect of the sex composition of the executives on the earnings losses of new mothers. First, the earnings losses of new mothers may by determined by individual-level heterogeneity that is correlated with with the sex composition of the executives. For example, mothers who are more likely to choose to reduce their labor supply after the birth of a child may be more likely to select into firms that have more women in leadership positions. Second, firms that have more female executives may differ in other ways that affect the outcomes of new mothers. Thus, it is possible that the sex composition of the leadership at the firm affects the outcomes of new mothers, but other differences across firms and workers counteract these effects. We investigate this possibility by assessing the robustness of our findings within more homogeneous groups of workers and firms.

Figure 8 presents estimates based on subsamples defined by the education of the mother. We group the data into four educational categories that include: less than high school, high school, some college, and Bachelor's Degree or higher. In general, both the immediate and long-term earnings penalties associated with having a child are increasing in the education of the mother. However, within each education category, we continue to find no relationship between the earnings losses and the sex composition of the executives at the firm.

Figure 9 presents estimates based on subsamples defined by the race/ethnicity of the mother. The earnings losses are smallest for Black non-Hispanic mothers. Within each race/ethnicity category, we continue to find no relationship between the earnings losses and the sex composition of the executives at the firm.

Figure 10 illustrates that the lack of relationship between the motherhood penalty and the sex composition of executives is robust within subsamples defined by employer size. Our measure of executives (top three earner) may be a more accurate measure within smaller employers, and these top earners may be more likely to work directly with the mothers at small employers and employers that have a single establishment. Thus, it is possible that the lack of relationship between the outcomes of new mothers and the sex composition of the top earners is driven by measurement error. However, Figure 10 illustrates that this lack of relationship within subsamples defined by employer size as well as among single establishment employers.

Figure 11 presents estimates based on an alternative definition of executive, defined by the top earner at the firm, as opposed to the top three earners. Panel A indicates that the earnings penalties associated with childbirth are the same for women at employers with male versus female top earners. Panel B breaks out the results for female executives by whether that executive was ever a mother herself. It is possible that women who are themselves mothers might be more sympathetic to the challenges faced by mothers, and therefore the effects might be largest for this group. However, we find that the earnings losses for new mothers are the same regardless of whether the top earner at the employer is a man, a women

who is not a mother, and a women who is a mother.

4.3 Alternative Outcomes

We also estimate the effect of the female share of firm leadership on three other outcomes: i) the probability of separating into nonemployment, ii) the likelihood of being employed full-time one year later, and iii) the probability of being employed at the same employer one year later. These outcomes are not well suited to the analysis that exploits the panel regression, thus we estimate the effect on a sample that includes one observation per individual with controls for coworker fixed effects as well as a vector of individual-level covariates. The results are presented in Table 3. Mothers at employers with more female executives are slightly more likely to separate into nonemployment in the one year period surrounding the birth of their child. However, there is no relationship between the sex composition of the executives and the probability of either being full time employed or at the same employer one year after giving birth.

4.4 Alternative Empirical Strategy Using Changes in Executives

The previous section shows that there is little relationship between the labor market consequences of childbirth and the sex composition of leadership within the firm. Our empirical strategy that compares mothers to similar coworkers addresses the concern that workers at firms with more women in leadership positions may be on different career trajectories. However, it is possible that the differences are specific to new mothers, and are not common to all female coworkers. The robustness of our findings within subsamples defined by both employer and worker characteristics provides some evidence against this but we cannot rule out the possibility entirely. In this section, we take an alternative approach and study the outcomes of mothers who have given birth before and after the top executive at the employer changes. This strategy aims to control for time-invariant factors at the employer that shape the labor market outcomes of new mothers.

We define an executive transition event as occurring in quarter t if the stable top earner at the employer in quarter t is different from the stable top earner in quarter t+2.[18] An individual is the stable top earner in quarter t if they have the highest earnings at the employer in quarter t and seven of the eight preceding quarters (not all employers have a stable top earner in all quarters). An individual is the stable top earner in quarter t+2 if they have the highest earnings at the employer in quarter t+2 and seven of the eight subsequent quarters. For each executive transition event, we measure the sex of the two stable top earners. There are four types of transitions that are defined by the sex of the first stable earner (male or female) and the sex of the second stable earner (male or female).

We exploit variation in the timing of births around the executive transition events in order to estimate how the sex of the top earner at the firm affects the labor market outcomes of new mothers. Specifically, we estimate the following specification,

$$y_{it} = \alpha_i + \lambda_{m(i)j(i)t} + \gamma_{c(i)t} + \phi X_{it} + \sum_{k=-6}^{8} \beta^t \tilde{D}_{it}^k + \epsilon_{it} \tag{5}$$

where $\tilde{D}_{it}^k$ is an indicator equal to one if i is a mother, the stable top earner at employer j(i) is female, and the quarter t is k quarters after birth; m(i) indicates whether i is a mother or a coworker; j(i) is the employer of i in t=-4, which is four quarters prior to birth; $\lambda_{m(i)j(i)t}$ is a fixed effect for motherhood status by employer by quarter; and ϵ_{it} is a regression residual that is clustered at the level of the employer.[19] Note that $\lambda_{m(i)j(i)t}$ captures the earnings dynamics common to all mothers at the employer. Thus, β^t is the differential effect of having a child at an employer with a female versus a male top earner.

We estimate this specification on the same sample used to estimate equation 5 except for

[18] We identify the successor top earner in quarter t+2, in part, because earnings dynamics at the end and beginning of an employment spell may be affected by variation in the number of weeks worked during that quarter as well as special compensation for separations or new hires.

[19] All other variables are defined as in equation 4. Specifically, i is the individual; t is the quarter relative to birth (t=0 is the quarter of birth); y is quarterly earnings; α_i is an individual fixed effect; $\gamma_{c(i)t}$ is a quarter by coworker pair fixed effect; and X_{it} is a vector of covariates that includes the interaction between a quadratic in age and education.

three differences. First, to increase statistical precision, we use the full sample as opposed to the 25% random sample. Second, we require that the birth event be two years before or after an executive transition event in which the sex of the stable top earner changed. Third, to limit the sample to observations that contribute to the identification of β^t, we require that there be at least one birth event before and after the executive transition event.

The estimates based on equation 5 are presented in Figure 12. Because β^t represents the differential effect of having a child when the stable top earner is female versus male, Figure 12 displays the average earnings for new mothers at an employer with a top executive that is male plus the estimated effect. These results show that the earnings losses associated with having a child are not related to the sex of the top executive at the employer. We also present estimates of equation 5 based on a sample that only includes mothers (no co-workers), and we continue to find the same lack of relationship.

5 Conclusion

Childbirth and subsequent breaks from the labor market are a primary reason why the average earnings of women is lower than that of men. This paper uses linked survey and administrative data from the United States to investigate whether the sex composition of executives at the firm, defined as the top earners, affects the earnings and employment outcomes of new mothers. We are motivated by descriptive evidence that suggests that i) most of the male-female earnings gaps disappears after controlling for childbirth penalties and ii) the magnitude of the average male-female earnings gap within industries is strongly related to the representation of women in executive positions within that industry both in the cross-section and over time.

However, we find no evidence that the sex composition of the executives at the firm has a causal effect on the childbirth and motherhood penalties that impact women's earnings and employment. We compare new mothers' labor market outcomes to the outcomes of similar

co-workers, and we find that the earnings losses of new mothers are similar regardless of the share of executives that are female. We show that our finding of a lack of relationship between the number of women in top leadership positions at a firm and the earnings and employment outcomes of new mothers is robust when considering more homogeneous subsets of workers and firms. Furthermore, we continue to find a lack of a relationship when using an empirical strategy that compares the outcomes of new mothers within firms before and after changes in the executives at the firm. Thus, our results do not appear to be driven by the nonrandom sorting of workers into firms.

While our results suggest that increasing the representation of women in executive positions within the firm is not likely to be a successful strategy for reducing the motherhood penalty, there may be other good reasons for for promoting more equitable representation of women in leadership positions. For example, such changes could reduce the male-female wage gap through channels other than reducing the motherhood penalty. In addition, even though we find no effect on earnings, it is possible that female executives do shape the experiences and outcomes of new mothers in other ways. However, given the central importance of the motherhood penalty in determining the male-female earnings gap, it would seem important for future research to better understand whether there are other firm-level policies that could minimize the career costs that women pay when they have a child.

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6 Tables

Table 1: Frequency Top Earner is a Given Occupation

	Executive / Manager		Professional		Supervisor	
	Female (1)	Male (2)	Female (3)	Male (4)	Female (5)	Male (6)
A. Not Weighted						
<90th percentile	7.31	9.66	2.56	2.44	4.81	7.75
90th percentile +	27.93	32.88	5.88	6.84	10.16	15.85
95th percentile +	37.00	39.48	7.31	8.01	9.83	14.78
99th percentile +	51.45	50.07	9.46	11.35	8.31	11.57
top 3	31.27	39.16	6.63	7.95	12.33	17.25
top 1	28.48	35.81	6.85	9.27	13.37	17.61
B. Employment Weighted						
<90th percentile	6.30	7.43	2.54	2.94	5.06	7.42
90th percentile +	25.94	18.34	9.49	7.56	12.60	17.77
95th percentile +	32.48	20.35	13.52	9.73	12.35	20.06
99th percentile +	39.70	25.83	14.68	12.75	9.97	19.78
top 3	49.39	54.06	9.42	12.06	8.86	11.84
top 1	46.38	57.3	12.82	10.70	8.57	11.46

Notes: Each column reports the frequency with which ACS respondents who are top earners at their firm report having an occupation of Executive or Manager (columns (1) and (2)), Professional (columns (3) and (4)), or Supervisor (columns (5) and (6)). Whether the ACS respondent is a top earner at their firm is determined using the full-quarter earnings of the respondent and all their co-workers at the time of the survey. The table distinguishes between female top earners (columns (1), (3), and (5)) and male top earners (columns (2), (4), and (6)). Panel A, which shows unweighted statistics, can be interpreted as the likelihood that a randomly selected top earner reports having a given occupation. Panel B weights top earning ACS respondents by the number of employees at their firm — and thus can be interpreted as the likelihood that if a randomly selected worker has a female (or male) top earner at their firm, then that top earner will have a given occupation.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics and the American Community Survey.

Table 2: Summary Statistics by Sex Composition of Executives

	Number of Top 3 Earners that are Female			
	zero	one	two	three
	(1)	(2)	(3)	(4)
A. Individual Characteristics				
age	29.90	29.90	29.60	28.90
birth order	2.06	2.08	2.11	2.14
education: less than high school	0.05	0.05	0.05	0.05
education: high school	0.16	0.14	0.14	0.17
education: some college	0.35	0.31	0.35	0.41
education: college plus	0.44	0.50	0.46	0.37
White non-Hispanic	0.84	0.84	0.84	0.83
Black non-Hispanic	0.07	0.07	0.08	0.09
Hispanic	0.16	0.17	0.17	0.15
Asian non-Hispanic	0.07	0.06	0.05	0.05
Native American non-Hispanic	0.01	0.01	0.01	0.01
tenure four quarters prior to birth	15.80	15.70	15.10	13.80
log quarterly earnings prior to birth	9.11	9.06	8.95	8.75
A. Employer Characteristics				
firm age	22.50	21.90	20.60	18.90
log firm size	7.98	7.53	6.67	5.70
industry=Finance and Insurance	0.11	0.09	0.05	0.04
industry=Educational Services	0.13	0.26	0.27	0.14
industry=Health Care and Social Assistance	0.18	0.21	0.32	0.51
industry=Manufacturing	0.14	0.05	0.02	0.01
industry=Retail Trade	0.10	0.08	0.06	0.07
industry=other	0.34	0.31	0.28	0.24
unique number of mother-birth events	80,000	40,000	17,000	6,000

Notes: This table presents summary statistics for the new mothers. The each column presents statistics for a different sample defined by the number of top three earners at the employer that are female. Each row presents the average value of the variable defined by the first column.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Table 3: Effect of Female Leadership

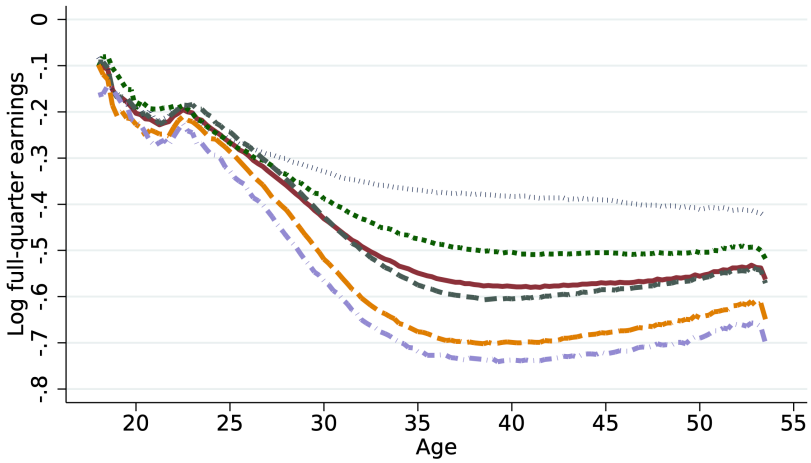
	separation to nonemployment		employed full-time one year later		at same employer on year later	
	(1)	(2)	(3)	(4)	(5)	(6)
mother	0.045***	0.042***	-0.070***	-0.069***	-0.007***	0.014***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
mother×1/3 top earners female	0.004*	0.004*	0.001	0.001	-0.004	-0.001
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
mother×2/3 top earners female	0.006	0.006*	0.001	0.000	-0.003	0.003
	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)
mother×3/3 top earners female	0.011*	0.011*	0.001	-0.001	-0.003	0.004
	(0.005)	(0.005)	(0.006)	(0.006)	(0.008)	(0.008)
additional controls		X		X		X
observations	286,000	286,000	286,000	286,000	286,000	286,000

Notes: Each column presents estimates from a separate regression. The outcome variable is defined by the column. All regressions include a fixed effect for the coworker pair, and the interaction between an indicator equal to one if the individual is a mother and the number of top three earners at the employer that are female. The even numbered columns contain an additional vector of controls, which includes: the interaction between a quadratic in age and education, race, ethnicity, tenure, and average log earnings in the four through eight quarters prior to birth. Standard errors are clustered at the coworker pair and are reported in parentheses.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.
*** p≤0.001, ** p≤0.01, * p≤0.05

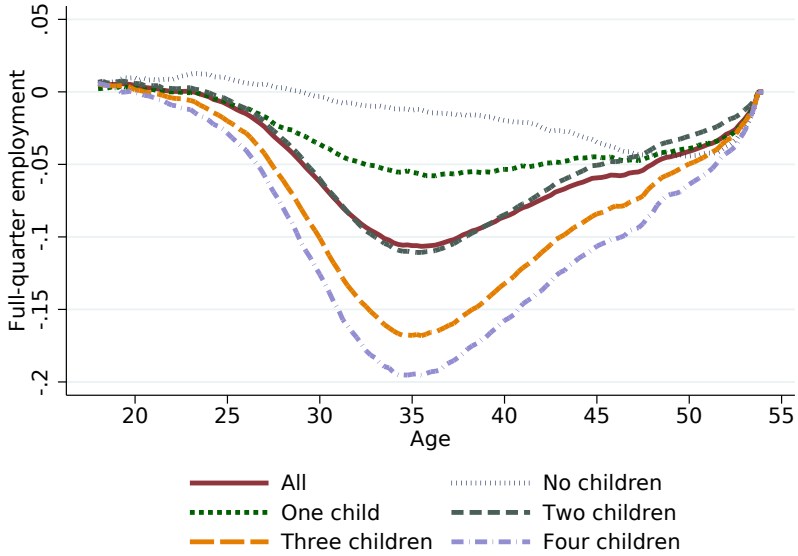
7 Figures

Figure 1: The Motherhood Penalty

(a) Log full-quarter earnings



(b) Full-quarter employment

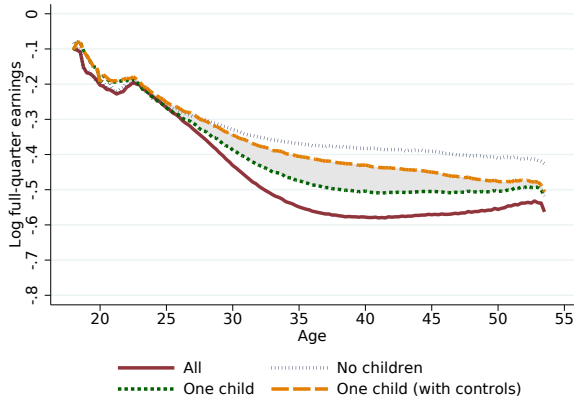


Notes: This figure plots coefficient estimates from two regressions of log full-quarter earnings on either i) age-by-female indicator variables (*All*), or ii) the interaction of indicator variables for each woman's age (in quarters) and the total number of children that the woman has between the ages of 18 to 40 (*No children, One child, Two children, Three children, and Four children*). For both regression specifications, men's log full-quarter earnings by age serve as the baseline comparison group (regardless of the number of children in the man's household). Both regression specifications include control variables for age-specific effects of race and education, as well as time fixed-effects.

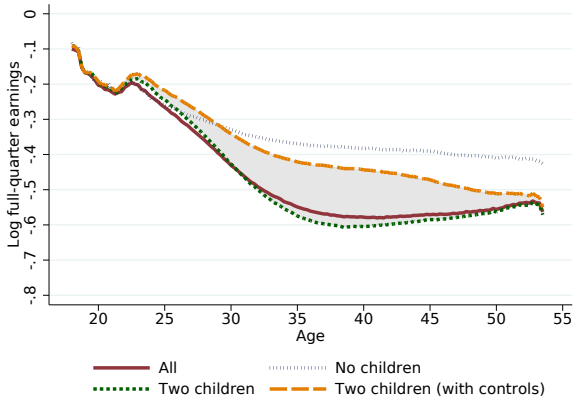
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Figure 2: The Motherhood Penalty - Controlling for Birth Penalties

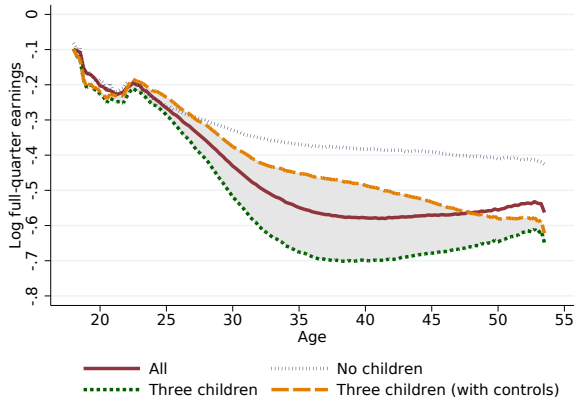
(a) One Child



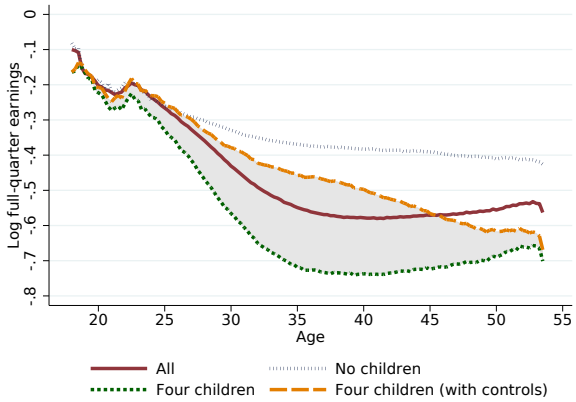
(b) Two Children



(c) Three Children



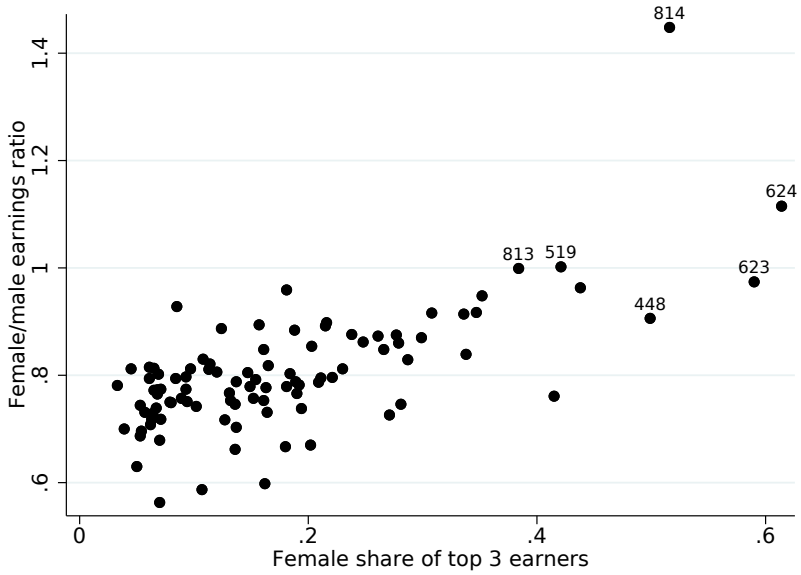
(d) Four Children



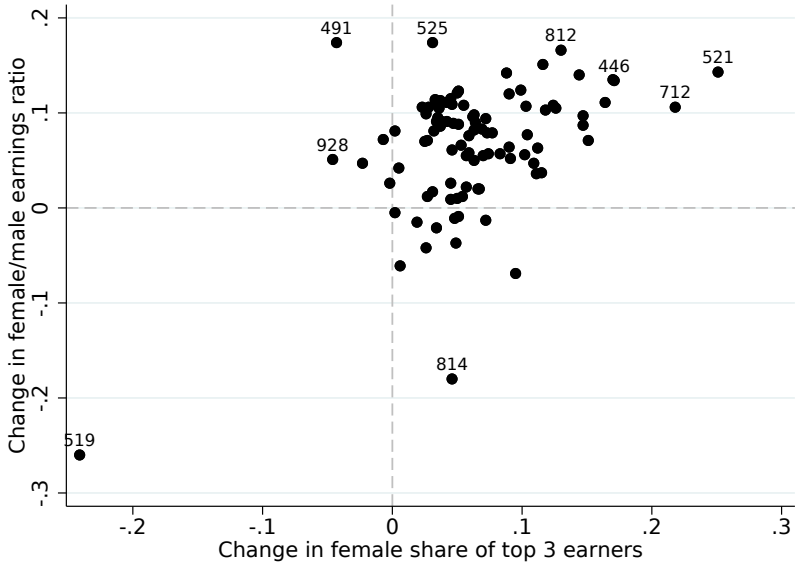
Notes: These figures plot estimates of the male-female earnings gap and the role of childbirth - where each figure groups women according to the total number of children that the women have between the ages of 18-40. Each figure plots the coefficient estimates from three regression specifications of the log full-quarter earnings on either: i) age-by-female indicator variables (the solid red *All* line), ii) the interaction of indicator variables for each woman's age (in quarters) and the total number of children that the woman has between the ages of 18 to 40 (the dotted green *X children* line), and iii) the same age-specific total number of children interaction as in ii, but also including dynamic controls for the earnings penalty associated with childbirth in each quarter-since-birth ranging from one year before childbirth to 18 years after childbirth, allowing for distinct effects for the first, second, third, and fourth childbirth (the dashed orange *with controls* line). For comparison, each figure also plots the coefficient estimates for women with no children (the dotted light blue *No children* line). In each regression specification, men's log full-quarter earnings by age serve as the baseline comparison group (regardless of the number of children in the man's household). All regression specifications include control variables for age-specific effects of race and education, as well as time fixed-effects.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Figure 3: Female Leadership and the Earnings Gap by Industry

(a) Cross-sectional female leadership and earnings gap relationship



(b) Change in female leadership and earnings gap: 1995 to 2017

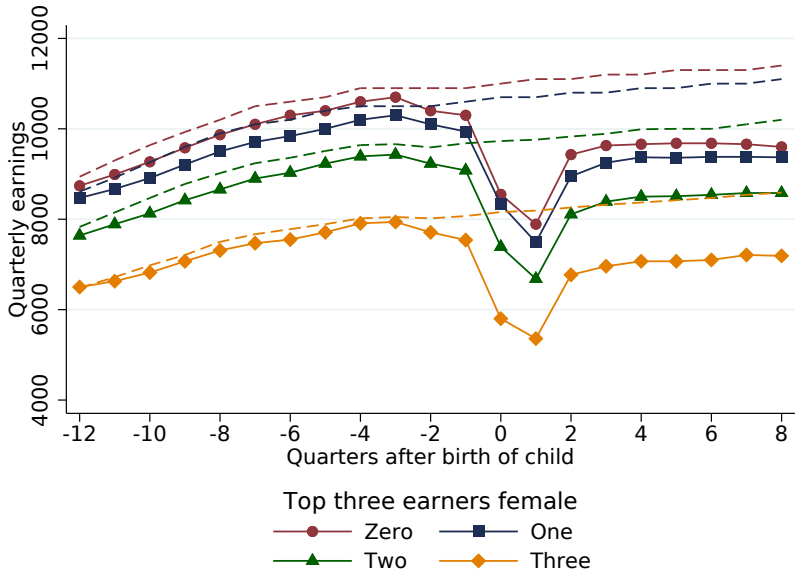


Notes: The X-axis of panel (a) plots the employment-weighted average female share of top 3 full-quarter earners within firms in each 3-digit NAICs industry over the period from 1995 - 2017. The X-axis of panel (b) plots the industry-specific change in this female share of top 3 earners between the years 1995 and 2017. The Y-axis of panel (a) plots the employment-weighted average within-firm ratio of female-to-male full quarter earnings for each 3-digit NAICS industry. The Y-axis of panel (b) plots the change in this earnings ratio between the years 1995 and 2017.

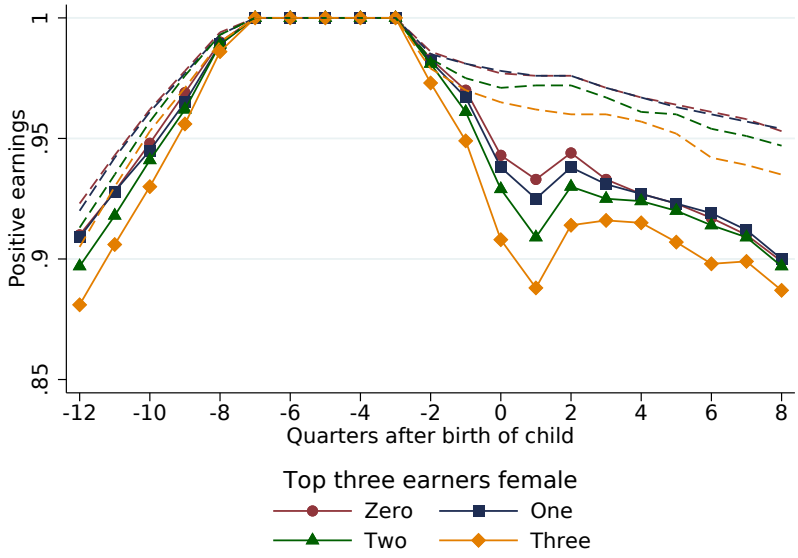
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics.

Figure 4: Average Outcomes Before and After Childbirth

(a) Earnings



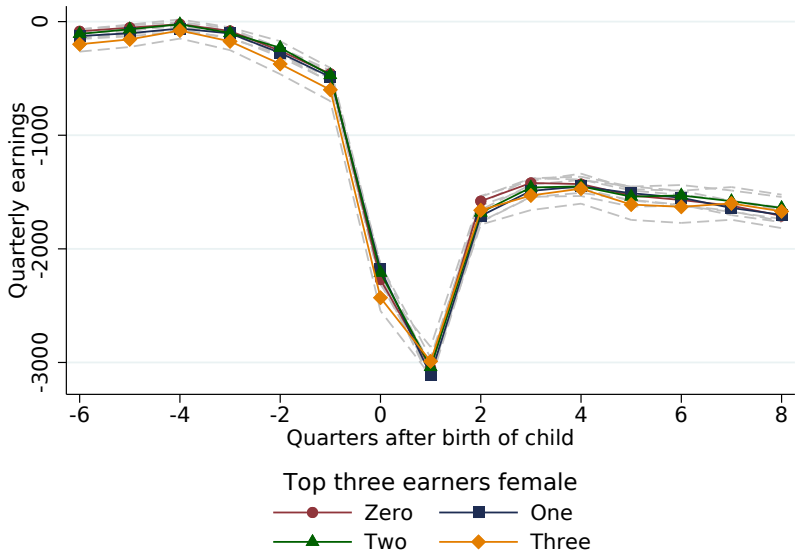
(b) Employment



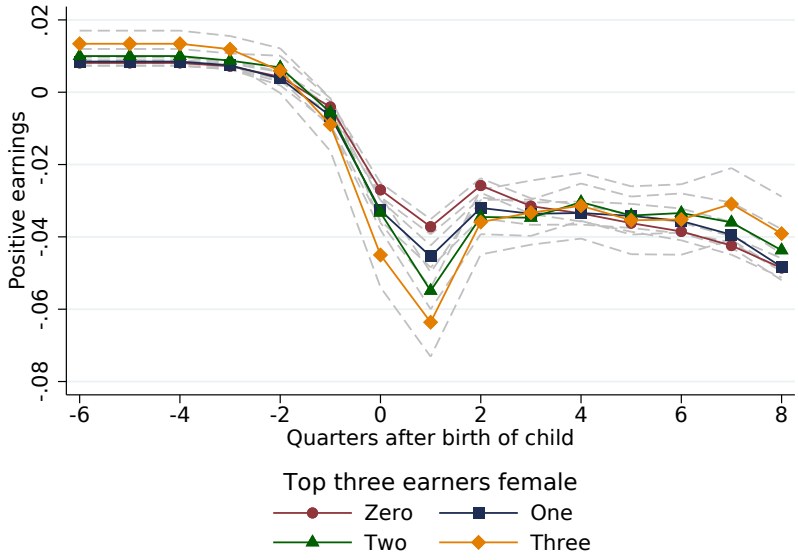
Notes: This figure presents the average outcomes for mothers (solid lines) and coworkers (dashed lines) 12 quarters before and 8 quarters after the birth of a child. Panel A presents the average value of quarterly earnings and Panel B presents the proportion of individuals that are employed. Within each panel, the four solid lines present the average values for groups of women defined by the number of top three earners at their employer that are female. The four dashed line present analogous estimates for the coworkers.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Figure 5: Motherhood Penalty by Sex of Executives

(a) Earnings

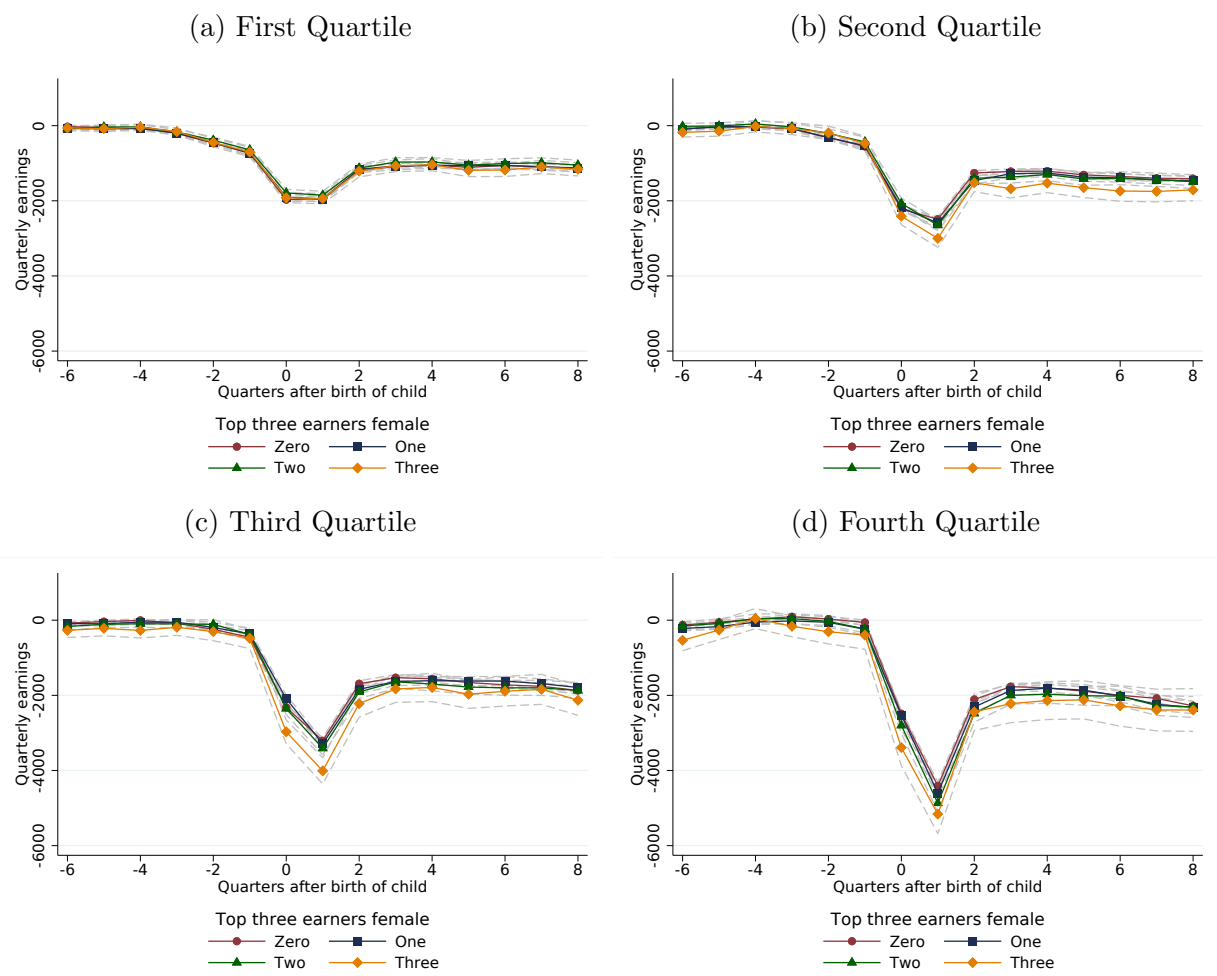


(b) Employment



Notes: This figure presents estimates from equation 4. The outcome variable in Panels A and B is quarterly earnings and an indicator equal to one if the individual has positive earnings, respectively. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample includes approximately 6 million person quarter observations. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

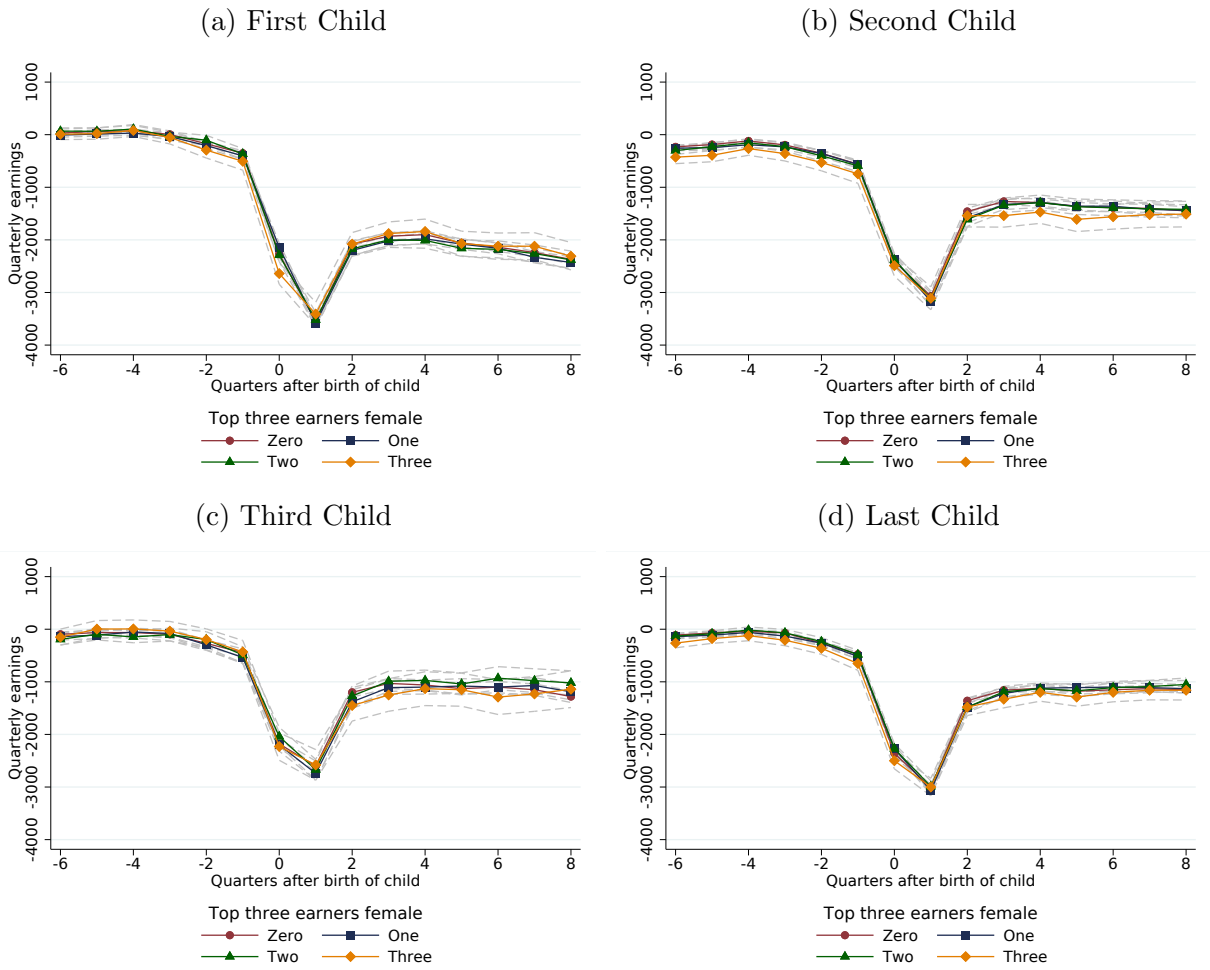
Figure 6: Motherhood Penalty by Sex of Executives and Pre-Birth Earnings



Notes: This figure presents estimates from equation 4. The outcome variable is quarterly earnings and Panels A through D present results estimated on a subsamples defined by the quartile of pre-birth earnings measured in the # quarter prior to the quarter of birth. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample in Panels A through D includes approximately 1.6, 1.5, 1.4, and 1.5 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

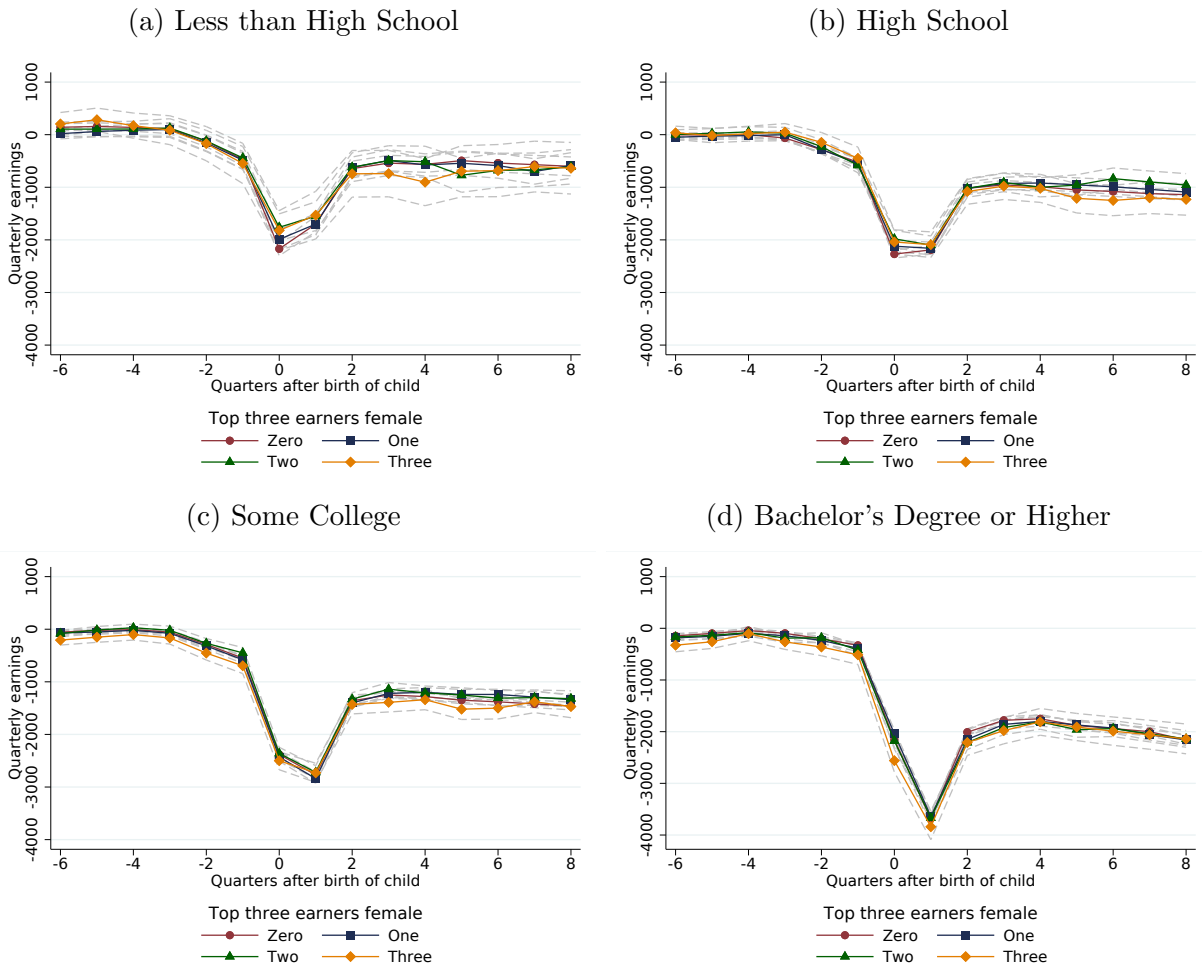
Figure 7: Motherhood Penalty by Sex of Executives and Birth Order



Notes: This figure presents estimates from equation 4. The outcome variable is quarterly earnings and Panels A through D present results estimated on a subsamples based on birth order including: first child, second child, third child, and last child, respectively. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample in Panels A through D includes approximately 2.4, 2.1, 0.9, and 3.4 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

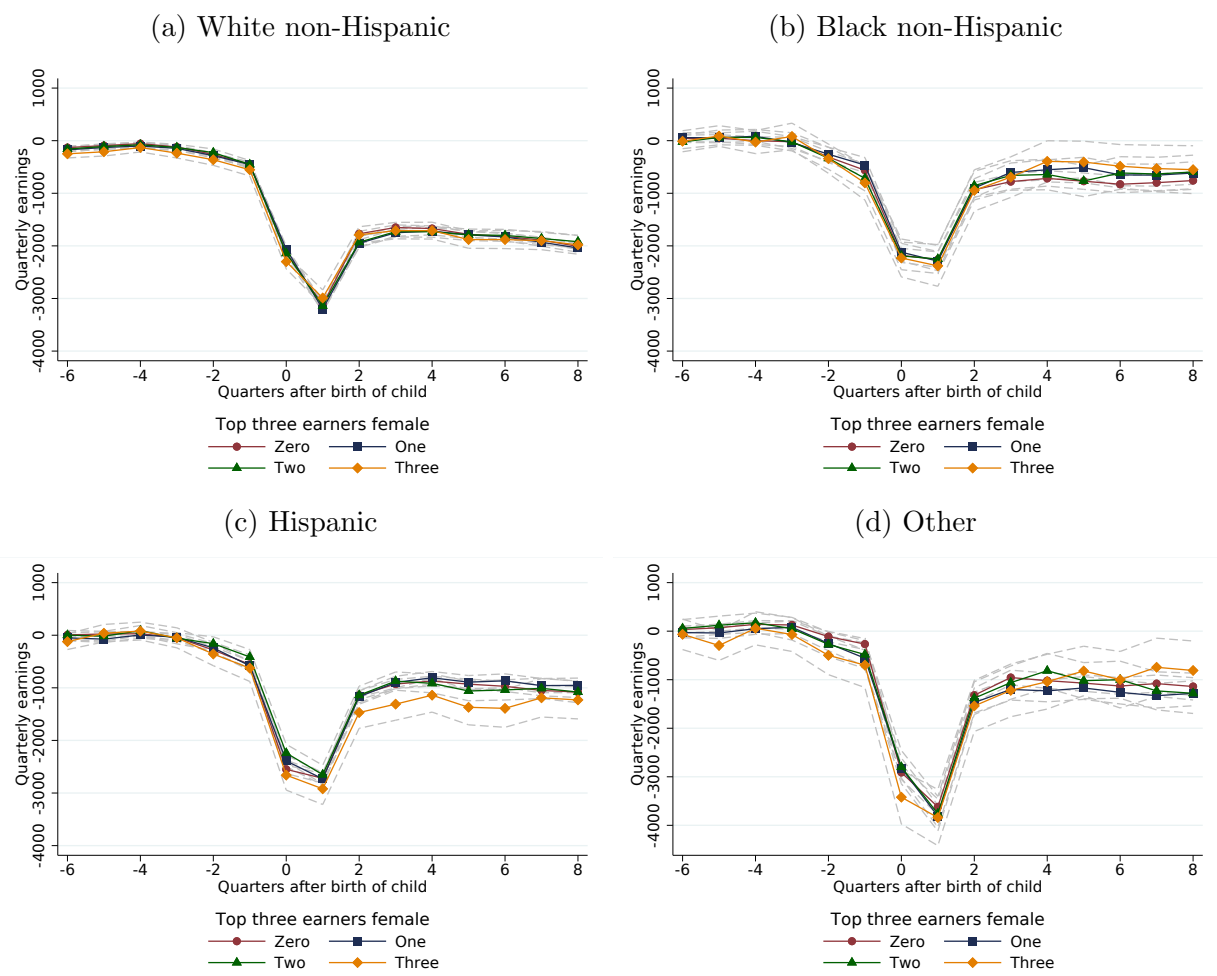
Figure 8: Motherhood Penalty by Sex of Executives and Education



Notes: This figure presents estimates from equation 4. The outcome variable is quarterly earnings and Panels A through D present results estimated on a subsamples based on the mother's education and the categories include less than high school, high school, some college and Bachelor's Degree or higher, respectively. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample in Panels A through D includes approximately 0.3, 0.9, 2.1, and 2.8 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

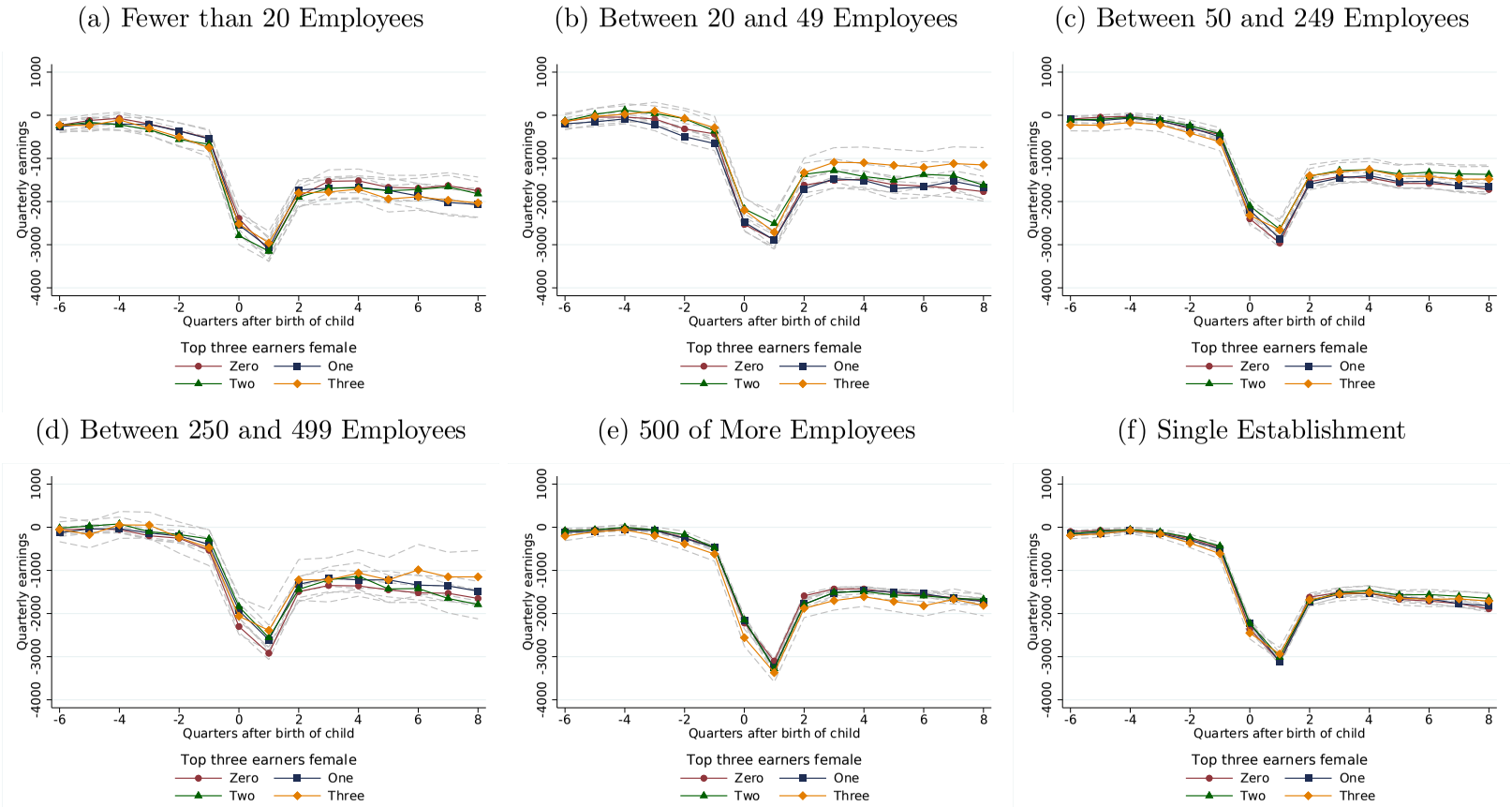
Figure 9: Motherhood Penalty by Sex of Executives and Race/Ethnicity



Notes: This figure presents estimates from equation 4. The outcome variable is quarterly earnings and Panels A through D present results estimated on a subsamples based on the mother's race/ethnicity and the categories include White non-Hispanic, Black non-Hispanic, Hispanic, and other, respectively. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample in Panels A through D includes approximately 4.2, 0.4, 1.0, and 0.5 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Figure 10: Motherhood Penalty by Sex of Executives and Employer Size

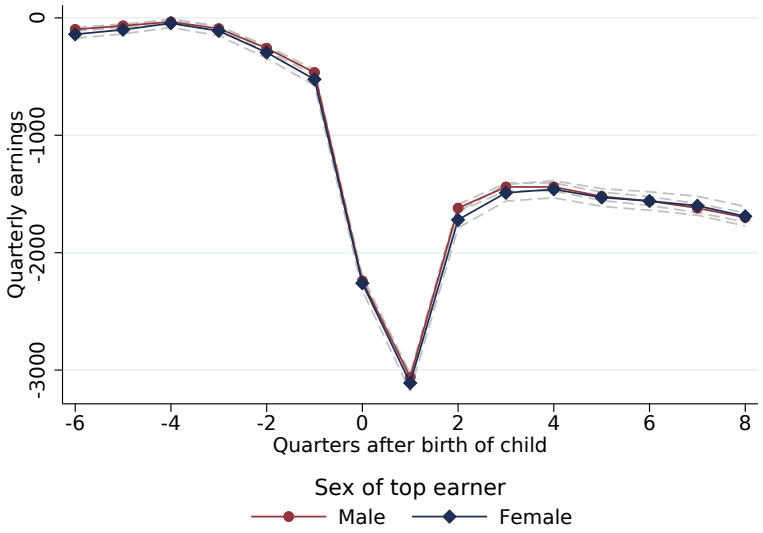


Notes: This figure presents estimates from equation 4. The outcome variable is quarterly earnings and Panels A through D present results estimated on a subsamples based on the employer size. The four lines within each panel display estimates of $\beta^{l,k}$ for a different value of k, which denotes the number of top three earners at the firm that are female. The horizontal axis represents l, which is the time relative to the quarter of birth. The sample in Panels A through D includes approximately 0.3, 0.4, 0.9, 0.4, and 4.1 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

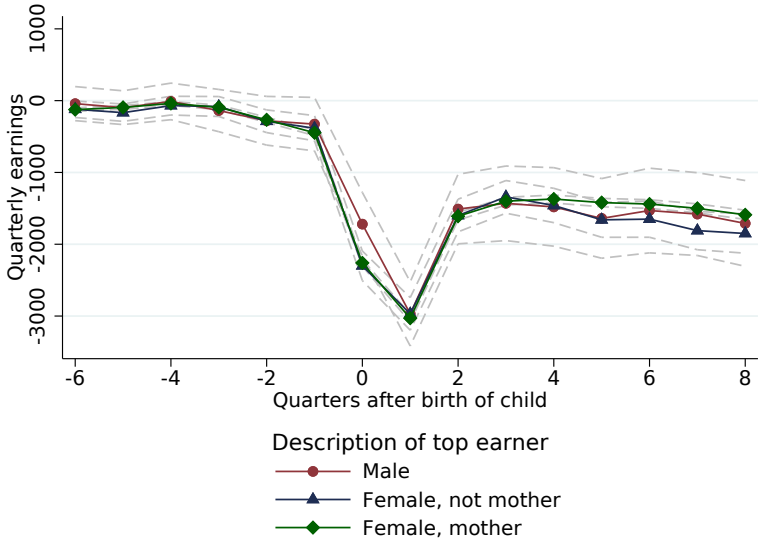
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Figure 11: Robustness to Alternative Measures of Executives

(a) Top Earner



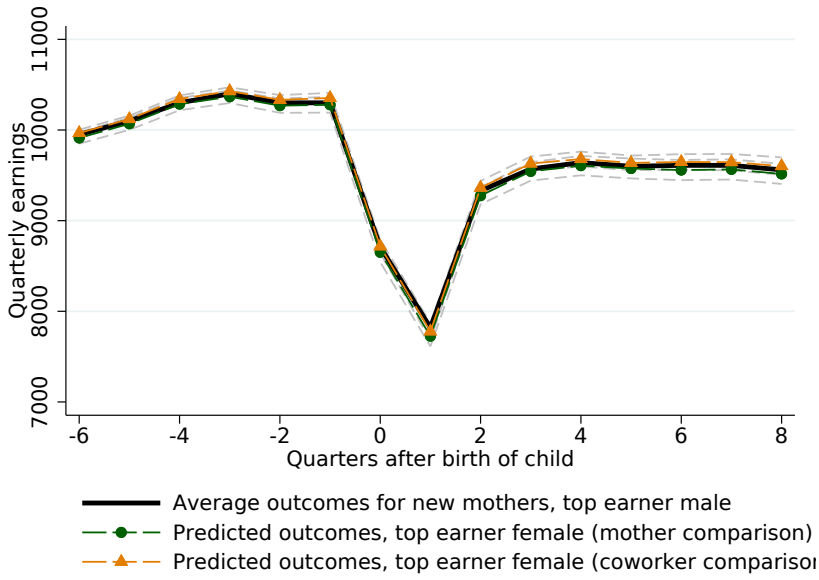
(b) Top Earner is Mother



Notes: This figure presents estimates from a modified version of equation 4, which allows for a different effect of having a child based on characteristics of the top earner, as opposed to the top three earners at the firm. The outcome variable is quarterly earnings. Panel A presents estimates for two types of mothers based on whether the top earner at the employer was male or female. Panel B presents estimates for three types of mothers based on whether the top earner at the employer was male, female and not ever a mother or female and at some point a mother. The sample in Panel A and B includes 6.1 and 2.0 million person quarter observations, respectively. Standard errors are clustered at the level of the coworker pair and 95% confidence intervals are depicted by the dashed lines.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

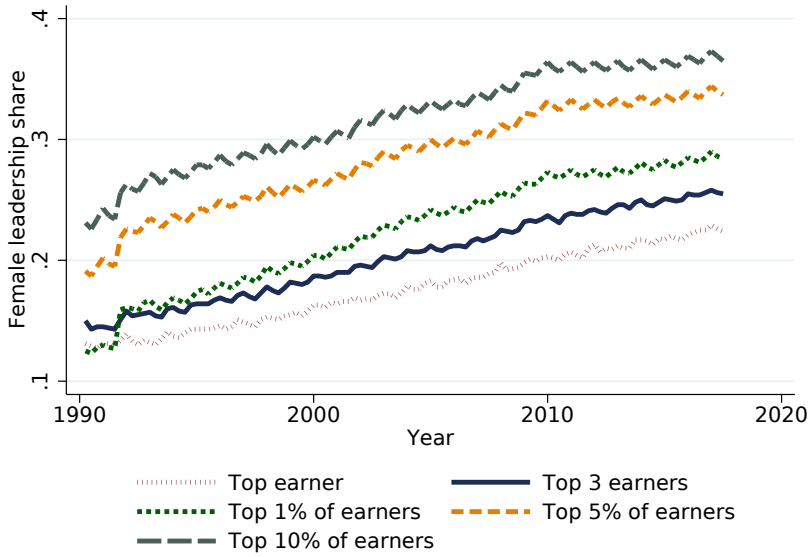
Figure 12: Effect of Female Manager Using Executive Transitions



Notes: This figure presents estimates from equation 5. The estimates are displayed as the average earnings of mothers at an employer with a top stable earner who is male plus the point estimates from the regression. The sample includes approximately 4.0 million person quarter observations, respectively. Standard errors are clustered at the level of the employer and 95% confidence intervals are depicted by the dashed lines. Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Appendix A Additional Results

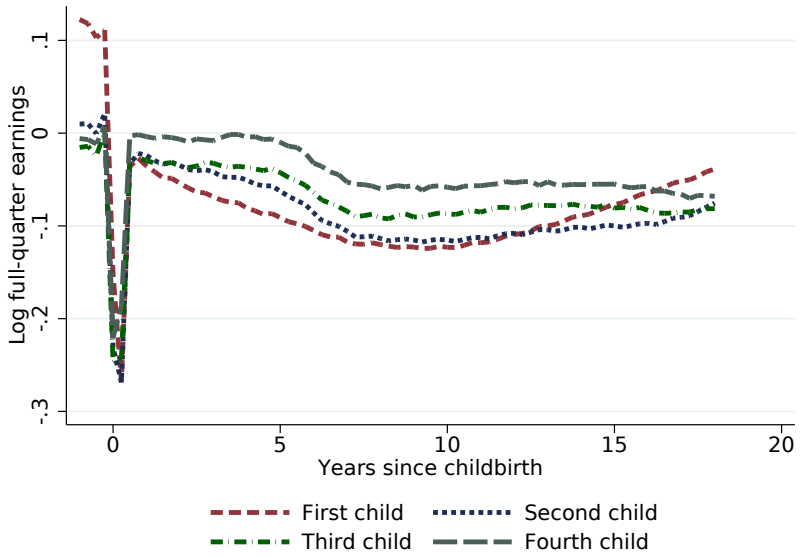
Figure A.1: Share of Executives that are Female Over Time



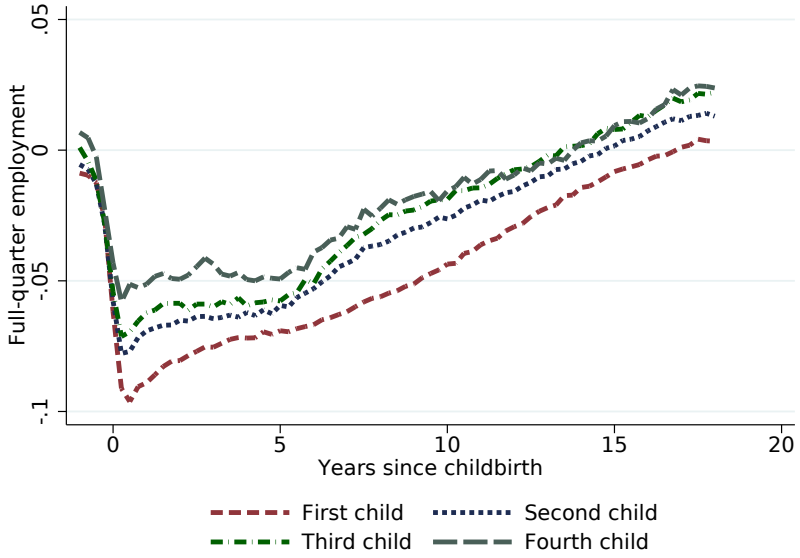
Notes: This figure shows the evolution in the share of executives that are female from 1990 through 2017. Although all series identify executives as the top earner(s) at a firm in the LEHD, each series uses a different threshold in determining which individuals qualify as a top earner. The underlying sample of firms from which executives are drawn changes slightly for each series since the minimum firm size grows slightly as the top earner threshold becomes more inclusive (i.e. classifying more workers at a given firm as executives). Source: Author's calculations based on data from the Longitudinal Employer-Household Dynamics.

Figure A.2: Motherhood Penalty

(a) Log Earnings



(b) Employment



Notes: These figures plot estimates of the quarterly evolution of the log full-quarter earnings penalty, Panel (a), and full-quarter employment rate penalty, Panel (b), associated with childbirth from one year before the childbirth to 18 years after the childbirth. These penalties are allowed to differ for the first, second, third, and fourth childbirth. The regression specification includes fixed effects controlling for the woman's age (in quarters), race, education, and total number of childbirths between the ages of 18-40, as well as time fixed effects.

Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics, the 2000 and 2010 Decennial Censuses, and the American Community Survey.

Table A.1: Frequency top 3 earner given occupation by firm size

Firm Size	Executive / Manager		Professional		Supervisor	
	Female (1)	Male (2)	Female (3)	Male (4)	Female (5)	Male (6)
0-19 employees	13.01	23.78	9.52	25.98	11.64	21.20
20-49 employees	9.40	19.10	5.22	15.94	6.60	12.65
50-249 employees	4.19	11.00	1.85	6.71	1.88	4.61
250-499 employees	1.87	6.11	0.81	3.11	0.78	1.97
500+ employees	0.71	2.38	0.27	1.15	0.33	0.85

Notes: Each column reports the frequency with which ACS respondents who are one of the top three earners at their firm report having an occupation of Executive or Manager (columns (1) and (2)), Professional (columns (3) and (4)), or Supervisor (columns (5) and (6)). Whether the ACS respondent is a top earner at their firm is determined using the full-quarter earnings of the respondent and all their co-workers at the time of the survey. The table distinguishes between female top earners (columns (1), (3), and (5)) and male top earners (columns (2), (4), and (6)). The sample of firms differs for each row based on the firm size (number of full-quarter employees at the respondent's firm at the time of the ACS survey).
Source: Author's calculations based on matched data from the Longitudinal Employer-Household Dynamics and the American Community Survey.