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An Analysis of the Relationship Between the Navy's Maternity Leave Policy and Reenlistment Rates

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Abstract

In 2015, the Navy tripled the length of maternity leave from 6 to 18 weeks. In 2016, it reduced the length of leave to 12 weeks to match the other armed services. For most sailors who give birth, longer maternity leave will reduce the number of weeks they work. Additional leave could, however, also lead to higher reenlistment rates, thereby potentially increasing the net number of weeks of work for the entire enlisted inventory. We analyze the change in female sailors' reenlistment rates relative to those of male sailors before and after the change in maternity leave policy. Although we cannot prove a causal relationship, we estimate that the increase in maternity leave is associated with a 3.7 percentage point increase in female first-term reenlistment rates. We also estimate that higher reenlistment rates increase weeks of work by over three times the number of weeks lost because of the additional leave.

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Executive Summary

Prior to 2015, the Navy provided 6 weeks of paid maternity (convalescent) leave to active component female sailors to be taken consecutively immediately after the birth of the child. Over an 8-month period in 2015 and 2016, the Navy announced two changes to the amount of leave that could be taken: an increase to 18 weeks (to be used over the child's first year) and then a cutback to 12 weeks (to be taken consecutively immediately after the birth of the child).

Additional maternity leave taken by sailors who give birth decreases the amount of work that they perform at their commands. Yet, if sailors—particularly female sailors—view the increase in leave positively, it could improve reenlistment rates. The additional weeks of work created by higher reenlistment rates could offset the weeks of work lost by those who use additional maternity leave. Higher reenlistment rates could also reduce recruiting and training costs.

Current research does not shed light on how sailors might react to additional maternity leave. To our knowledge, the relationship between maternity leave and retention in the Navy has not been analyzed. Moreover, research on civilian maternity leave is sparse and has limited applicability to the military. The impact of providing (additional) paid maternity leave has not been widely studied in a domestic context in the United States because only a handful of states provide it—and most of those only recently. Furthermore, military service obligations mean that, in many cases, sailors must return to their employer, whereas civilian employees may or may not be obligated to do so. Studies evaluating civilian employment continuity, therefore, may provide helpful context, but they may not be directly applicable to the Navy workforce.

Though offering additional leave should not affect whether sailors who give birth return to their positions, these additional benefits may increase female sailors' likelihood of reenlisting. This could apply both to sailors who have used maternity leave (e.g., additional leave may make them feel better about the Navy as an employer) and to those who believe that they might someday use such leave (e.g., it reduces perceived conflicts between motherhood and active service). Additional maternity leave could also affect women in general by demonstrating a broader commitment to workplace issues that specifically affect female sailors.

Our evaluation of the change in maternity leave policy aimed to answer three questions:

1. Did female sailors take additional maternity leave when it was offered?
2. Is the change in maternity leave policy statistically associated with changes in reenlistment rates of female sailors?
3. What is the estimated net effect of the policy change on weeks of work?

We accomplished our first goal by merging Defense Health Agency (DHA) medical claim data containing information on births to sailors between May 2011 and September 2016 with data from the Navy's electronic leave (e-leave) system from April 2011 through September 2017. The merged data allowed us to observe leave taken 30 days before and up to 365 days after sailors gave birth.

We addressed our second goal using enlisted personnel records to compare female and male reenlistment rates before and after the longer maternity leave policy went into effect. Our particular focus is on the reenlistment behavior of sailors with four-year obligations (4YOs). We analyzed the gender differences in reenlistment rates before and after the policy change separately for female sailors with and without children because the two groups have different reenlistment patterns and may react differently to the increase in maternity leave.

We accomplished our third goal by contrasting the additional weeks worked for the military through higher female reenlistment rates with the lower number of weeks worked from taking maternity leave.

We found the following:

- The amount of maternity leave taken in the first year after birth increased substantially for women who gave birth on or after January 1, 2015, the retroactive implementation date of the 18-week maternity leave expansion.
- After the expansion of maternity leave, we estimate that female sailors' reenlistment rates increased by 3.7 percentage points relative to those of male sailors. The estimated increase in reenlistment rates is driven by women who did not have children as of their first soft end of active obligated service (SEAOS).
- At average reenlistment lengths, many more weeks of work are gained because of increased reenlistment rates than are lost because of the increase in maternity leave.

Therefore, while working weeks are lost due to additional maternity leave, increases in reenlistment more than offset these losses. Our results suggest that this more likely reflects forward-looking decisions by female sailors without children than backward-looking decisions by female sailors with children. For example, the additional leave may provide some additional assurance to female sailors who do not yet have children that a multiyear service obligation is compatible with having a family.

Because our analysis of the relationship between the increase in maternity leave and the change in reenlistment rates uses data from both the 18-week and 12-week maternity leave policy periods, it is possible that our estimates are smaller than the true impact of the 18-week policy and larger than the impact of the 12-week policy. However, we have insufficient data to confidently estimate the impact of each policy in isolation. Similarly, although it would be helpful to estimate separate results for sailors with different marital and colocation statuses, there are too few women in each category for precise estimates.

We caution that our reenlistment analysis does not prove that the expansion of maternity leave *caused* the increase in reenlistment rates. Other policy changes, economic conditions, or other unobservable factors that affect men and women differently might contribute to our findings. Our results, however, are consistent with this explanation.

Secondary findings not presented here showed no relationship between attrition rates and policy implementation for women who gave birth, but this may be because of very low attrition rates for our sample in general. Finally, we note that in every quarter, some sailors who gave birth had no recorded maternity leave. This cannot be explained solely by sailors who left the Navy immediately after giving birth, or by examining whether other types of leave substituted for maternity and convalescent leave. This finding may be the result of data entry error or other factors that we have not yet identified.

The implications of our findings include the following:

- The positive association between increased maternity leave and female reenlistment rates is large enough to more than offset the workweeks lost due to the increase in maternity leave. More broadly, we note that personnel policies that appear to decrease weeks of work may, in fact, do the opposite if retention improves.
- If the Navy wants better visibility on the use of all types of leave—including maternity leave—it needs to continue to improve its e-leave system.

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Introduction

In July 2015, the Navy tripled the amount of maternity leave available to new mothers from 6 weeks to 18 weeks, backdating the expansion to January 2015. The 18 weeks of leave were to be used in the year following childbirth and did not need be used consecutively immediately after the birth. In February 2016, the increase in maternity leave was scaled back to 12 weeks to be taken consecutively and immediately after childbirth for births that occurred in late calendar year (CY) 2016 and after. This latter action still doubled the amount of leave that was available to sailors who gave birth in 2014 and earlier.

This report is part of a larger study in which we analyze the effects of personnel policy changes on manpower budgets and inventories. As part of the larger study, our study sponsor, the Assistant Secretary of the Navy (Financial Management and Comptroller) (ASN(FM&C)), asked us to analyze the personnel cost implications of the maternity leave policy change.

In civilian employment, a common concern about maternity leave is that women who take additional leave may be less tightly bound to their employers and may not return to work. Some evidence suggests, though, that more paid leave increases the probability that mothers will return to work for the same employer and stay in the workforce longer after giving birth.[1] Given the structure of service obligations in the Navy, however, many sailors who give birth are contractually bound to return to duty after taking leave. Thus, some results from civilian-sector maternity leave analyses may not be applicable to sailors given the unique contractual nature of active service. In addition, many of the civilian-sector maternity leave analyses focused on workforces that are demographically different from the Navy enlisted force.

By contrast, evidence from the civilian sector that women take more maternity leave when a paid policy is introduced or expanded is potentially applicable to military servicemembers. Thus, in the case of expanding maternity leave for sailors, the larger concern is that it reduces weeks of work.

Although sailors who give birth may be obligated to return to their positions regardless of the quantity of leave offered, receiving additional benefits (or knowing that they will be eligible for them) may increase their likelihood of reenlisting. This could apply both to women who have used maternity leave (e.g., additional leave may make them feel better about the Navy as an employer) and to those who believe that they might someday use such leave (e.g., it may reduce

[1] We describe the civilian sector results in more detail in Appendix A.

perceived conflicts between motherhood and active service). Additional maternity leave could also affect women regardless of background or family goals by demonstrating a broader commitment to workplace issues that specifically affect female sailors.

To estimate the main personnel cost implications of the policy change, we address three interrelated research questions:

1. How did maternity leave use change when the policy of increased maternity leave was introduced? If leave use did not change in response to this policy, it would raise questions about the policy's implementation and might limit its broader impact.
2. Did female sailors reenlist at higher rates after the implementation of the increase in maternity leave, and, if so, did the association of the policy change with reenlistment rates differ for female sailors with and without children?
3. What is the estimated net effect of increased maternity leave on weeks of work?

The remainder of this report is organized as follows. In the next section, we examine the maternity leave policy changes in detail and describe how leave use changed over time using Navy leave data. In the third section, we describe our methodology and data used to estimate the association between the change in maternity leave policy and changes in reenlistment rates. We present results in the fourth section, including an estimate of the net changes in weeks worked before and after the policy change. A final section presents our conclusions.

Navy Maternity Leave

During an 8-month period in 2015 and 2016, the Department of the Navy (DON) announced two changes to its maternity (convalescent) leave policy. In this section, we describe these policy changes and how they affected reported maternity leave use in the Navy.

Changes to maternity leave policy

Before 2015, DON granted 6 consecutive weeks of maternity leave to be taken and immediately after the birth of a child. DON classified it as convalescent leave, and it was the same as the leave policy across the Department of Defense (DOD) regarding births to active component (AC) servicemembers.

In July 2015, the Navy announced that it was expanding maternity leave [1]. The new policy granted 18 weeks of leave to be taken throughout the year following the birth, only 6 of which needed to be taken consecutively immediately following the birth. The policy applied retroactively to all births in 2015. Under this policy, sailors were required to request all maternity-related leave from their commanding officers (COs), although these requests could not be refused. The Navy was the only service to make this change in policy, and it is not likely that sailors anticipated it. When the Navy put the new leave policy into effect, it began to classify maternity leave separately from general convalescent leave in its electronic leave (e-leave) system.

The policy announcement listed a range of rationales for the expansion of maternity leave. On a practical level, it was designed to increase retention through increased flexibility and provision of "meaningful opportunity" for sailors to pursue motherhood if they desired. It also reflected a desire to maintain a "diverse and inclusive" environment for sailors and Marines. Leave was intended not just for recovery from childbirth but also for "bonding with…[the] child, and preparing to go back to...serving in the Navy or Marine Corps." It would also contribute to the physical and psychological health of the mother.

Shortly after the July 2015 policy went into effect, DOD requested that the Navy bring its maternity leave policies in line with department-wide policies, and DOD officially announced a new department-wide maternity leave policy in February 2016 [2]. DOD established 12 weeks of maternity leave to be taken consecutively and immediately after childbirth. This leave is automatically granted, thereby avoiding having to request it from a superior. To maintain its previously announced policy commitment to sailors, the Navy decided that the 12-week policy would apply to conceptions after March 3, 2016, regardless of the date of birth. A *term* *pregnancy* (i.e., including early-term and term births but excluding preterm and postmature births) is defined as a length of gestation between 37 weeks, 0 days and 40 weeks, 6 days [3]. A conception date of March 4, 2016, therefore, might result in a term birth any time between November 4 and December 1, 2016.[2]

Figure 1 shows how maternity leave policy applies by date of term birth. While there were three distinct policies over the relevant time period, the implementation of the 18-week and 12-week policies divides sailors into five different categories by month of childbirth.

Figure 1. Maternity leave policy by approximate date of (term) birth

Births prior to January 2015

- 6 weeks consecutively and immediately following birth

Births in January 2015 through June 2015

- 6 weeks consecutively and immediately following birth; 12 additional weeks taken in first year after childbirth

Births in July 2015 to November 2016

- 18 weeks in the first year after childbirth (not necessarily taken consecutively and immediately following birth)

Births in November 2016 to December 2016

- 12 or 18 weeks, based on date of conception (if 12 weeks, taken consecutively and immediately following birth; if 18 weeks, taken in the first year after childbirth but not necessarily consecutively and immediately following birth)

Births in December 2016 to Present

- 12 weeks consecutively and immediately following birth

Source: CNA interpretation of [1], [3], and [4].

[2] Gestational age is typically counted from the first day of the last menstrual period (LMP). Some approximate the conception date by adding 14 days to the LMP. According to [4], the conception date had to be determined by a privileged health care provider.

Changes in maternity leave use

To analyze the association between changes in maternity leave and changes in reenlistment rates, it is helpful to first demonstrate that maternity leave use increased when the new policies were enacted. Changes in maternity leave policies might not be associated with changes in women's reenlistment decisions if the expanded maternity leave policy was in name only.

Birth data sources

To examine maternity leave use precisely, we must have accurate dates for when sailors give birth. We obtained data from the Defense Health Agency (DHA) on birth events.[3] The alternative was to use the data field indicating the number of minor dependents for each sailor in active duty Navy personnel records and assume that an increase in that number reflects the birth of a child. This latter method does not provide precise birthdates and may count increases in minor dependents that would not qualify for maternity or convalescent leave (e.g., acquiring stepchildren through marriage). We therefore believe that the DHA data are more complete and accurate than the dependents variable in the personnel files.

Leave data sources

We received electronic leave data from the Space and Naval Warfare Systems Command (SPAWAR). We merged these e-leave data to the birth data and to the personnel records. The merged data allowed us to count the amount of convalescence and/or maternity leave plausibly related to births that occurred between April 1, 2011, and September 30, 2016. Table 1 shows the amount of convalescence/maternity leave taken over an interval beginning 30 days before and ending one year after first childbirth.[4] The results displayed are for sailors with obligations of four, five, and six years.[5]

[3] DHA claim records indicate when a birth to a sailor occurred in a medical treatment facility (MTF) or when a birth to a sailor occurred in a non-MTF treatment facility based on information in the claim that was filed for reimbursement from DHA.

[4] This leave is only "plausibly" related to births during our observation period because convalescence may be assigned for reasons other than maternity. In addition, some sailors might have used maternity leave for a second birth within the observation period; our data do not tie leave types explicitly to births. Nevertheless, the vast majority of these leave types will be explicitly associated with the focal birth.

[5] Although the results for four-year obligation (4YO) sailors only are not presented separately here, they are quite similar to those shown in Table 1 and are available on request. The calculations in Table 1 also omit women who entered the Navy with children, never reached the fleet, had more than two months of service as of the first quarter in which they appear in our data, are not clearly classifiable as 4YO, 5YO, or 6YO, or gave birth before reaching the fleet.

Table 1. Days of convalescent or maternity leave taken 30 days before through one year after first childbirth

	CY 2011 Q2[a]–CY 2014 Q4	CY 2015 Q1–CY 2016 Q3
Total days available	42 days	126 days
Mean leave taken	32.4 days (77.1%)[b]	102.2 days (81.1%)
25th percentile	3 days (7.1%)	84 days (66.7%)
50th percentile	42 days (100.0%)	125 days (99.2%)
75th percentile	42 days (100.0%)	126 days (100.0%)
N	8,543	3,708

Source: CNA estimates using EMF data.

[a] Our calculations of leave taken are from the Navy's e-leave system. The first several quarters of data from the e-leave system provided to us did not appear to be complete, so our leave calculations are for births in the second quarter (Q2) of CY 2011 and after.

[b] Percentages show leave taken as a share of the maximum allowable leave.

Table 1 displays the distribution of combined convalescence and maternity leave taken because both were used to record maternity leave at different points in the 2011–2016 period. In particular, in the fourth quarter of CY 2015, both types of leave were used to refer to leave taken subsequent to childbirth.

The middle column shows leave associated with births before January 2015, for which 42 days were nominally available. The last column shows leave associated with births on or after January 1, 2015, for which 126 days were nominally available. The policy changed from 18 weeks to 12 weeks for term births during the fourth CY quarter of 2016. We therefore have quite limited data on leave taken exclusively during the period of the 12-week policy.

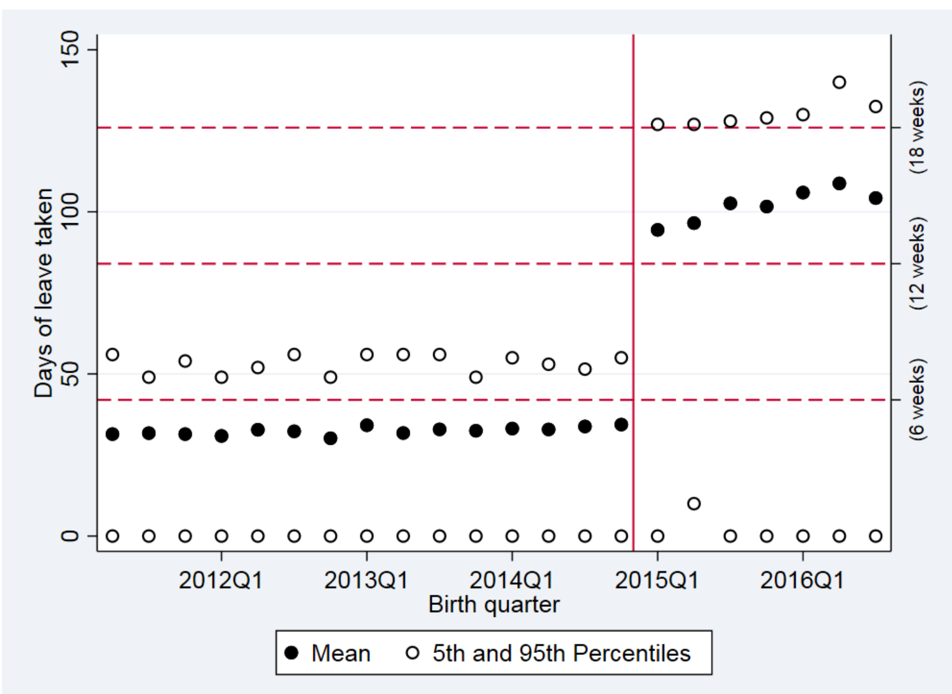
Table 1 shows that most women took the maximum amount of leave available. In both cases, the median amount of leave taken was over 99 percent of that available. However, some women took considerably less, pulling down the mean amount of leave taken. During the six-week policy, a quarter of births had three or fewer days of maternity leave recorded. In some of these cases, women may have substituted other forms of leave for maternity leave (e.g., if they had reached the maximum accruable amount of standard leave). In others cases, women may have exited the Navy and therefore no longer were eligible for maternity leave. However, 244 sailors (approximately 2 percent of those in Table 1) took 10 days or fewer of all types of leave combined, which raises concerns that some forms of leave may have been incorrectly (or not at all) recorded.[6]

[6] Of these 244 sailors, 37 (15.2 percent) exited in the same quarter that they gave birth, another 45 (18.4 percent) exited later within the same year, 79 (32.4 percent) remained for at least one year after giving birth, and 83 (34.0 percent) have not exited. Exiting the Navy is therefore not a sufficient explanation for why certain sailors appear to take so little leave surrounding a birth.

Figure 2 graphically displays the difference in leave taken across the two policy periods. Data points are aggregated by reporting quarter. The solid vertical line represents the beginning of the 18-week policy, while the dashed horizontal lines represent the amount of convalescence and/or maternity leave available under each policy.

Figure 2 shows an abrupt shift in the amount of leave taken beginning in the first quarter of 2015, when the 18-week policy was retroactively applied. Average leave taken rose slightly after the first two quarters of 2015, during which the policy applied only retroactively. This may have been because some women exited before becoming eligible for all 18 weeks of leave, because they had returned to work and were uncomfortable taking additional leave, or for other reasons. Nevertheless, a majority of women in each quarter took all (or almost all) allowed leave. A nontrivial minority took more leave than dictated by the relevant policy. Although we do not observe the reason for every instance of leave, this could represent convalescence from non-maternity-related illness or injury rather than overuse of maternity leave. In almost every quarter, at least 5 percent of births had no associated convalescence or maternity leave, confirming that apparent lack of leave use is not a time- or policy-specific issue.

Figure 2. Days of convalescent or maternity leave taken 30 days before and one year after first childbirth



Source: CNA calculations of leave reported in the Navy e-leave system for sailors who have a reported birth in DHA medical claims data, including sailors who report no leave taken.

The data presented in Table 1 and Figure 2 do not contain leave labeled as "ordinary," "separation," or "emergency," so we examined all leave taken around childbirth during this time. Appendix B contains analysis of the total amount of leave taken across all leave types around childbirth. Including these other types of leave increases the total amount of leave taken, but the patterns of leave taken in the periods before and after the policy change are very similar. Note that, even when we include all types of leave taken around childbirth, it does not completely explain why some women who gave birth appear to have taken no maternity leave.

The additional leave taken by sailors who gave birth in or after January 2015 necessarily equates to fewer working weeks by those sailors. However, this loss in working weeks may be partially, completely, or more than offset if the reenlistment rates of female sailors increased. In the next section, we discuss how we measure the change in reenlistment rates in the period surrounding the policy change.

Reenlistment Model: Methodology and Data

We have established that the use of maternity leave increased when the policy was expanded. The next step is to determine whether the change in policy is statistically associated with an increase in reenlistment rates. We use difference-in-differences (also referred to as diff-in-diffs) methodology to analyze how female reenlistment and male reenlistment changed relative to one another in the wake of the policy change. This model is useful for addressing the (functionally equivalent) questions: How does the change in female reenlistment rates before and after policy implementation compare with the change in male reenlistment rates before and after policy implementation, and did the gap between male and female reenlistment rates change after the policy?

Background on diff-in-diffs

Two simple comparisons of reenlistment rates around a policy change could be considered: (1) changes in reenlistment rates for the same group over time and (2) differences in reenlistment rates for two relevant groups. An example of the former is to compare the reenlistment rates for the group affected by the policy change over time (e.g., compare women's reenlistment rates before and after the policy change). An example of the latter is to compare reenlistment rates of a group affected by the policy change (e.g., women) with those of a group unaffected by the policy change (e.g., men) at a point in time.

Each comparison has drawbacks. In the first comparison, we can observe how female reenlistment rates changed before and after the policy, but the comparison ignores Navy-wide trends in reenlistment rates over the same time period. For example, male sailors' reenlistment rates may also have changed from before the policy change to after for reasons unrelated to the change in maternity leave policy. In the second comparison, we can observe how the reenlistment rates of the group that may be affected by the policy (women) differ from those of the group that is unlikely to be unaffected by it (men) at a point in time. By definition, however, the gender difference in reenlistment rates at a single point in time cannot establish whether either rate changed over time in response to a policy change.

The logic behind diff-in-diffs methodology is that if these two comparisons are combined appropriately, it can mitigate the weaknesses of each comparison. To employ diff-in-diffs methodology, we calculate the difference in female reenlistment rates before and after the policy change and the difference in male reenlistment rates before and after the policy change.

Then we compute the difference in the two differences—that is, the difference in female reenlistment rates before and after the policy change minus the difference in male reenlistment rates before and after the policy change.[7] As long as the reenlistment rates of our comparison group (male sailors) behaved similarly to that of our treatment group (female sailors) before the policy went into effect, differences in reenlistment rates after the policy change can be plausibly associated with the policy change.

Even so, we cannot guarantee that our findings perfectly represent the true impact of changing maternity leave. Diff-in-diffs methodology accounts for changes that affect men and women similarly (e.g., Navy-wide changes in selective reenlistment bonuses (SRBs)). However, any changes over time that affect men and women differently and that we do not explicitly account for could be included in our estimate of the association of maternity leave and reenlistment. For example, suppose that the Navy had introduced policies to reduce sexual harassment (SH) at the same time that maternity leave was expanded. Suppose further that the true impact of the SH policies on reenlistment rates was larger for women than for men. If we do not control for the effect of the SH policies, this could make our estimates of the association of maternity leave policy and reenlistment rates larger than the true association. See Appendix C for additional information on both the data requirements for valid diff-in-diffs estimates and the formal diff-in-diffs methodology.

Data

To ensure that we evaluated a uniform group of sailors whose reenlistment decisions were made in similar timeframes and affected by similar factors, we restricted our sample to 4YO sailors who had reached the fleet and had either committed to reenlisting within a year of their first soft end of active obligated service (SEAOS) or chose not to reenlist during this timeframe.[8]

We note that *committing* to reenlist (which we observe when a sailor has a new Current Enlistment Date) is not the same as *deciding* to reenlist, which is a private choice that can occur at any time and cannot be observed in our data. Similarly, unforeseen circumstances may prevent a sailor who reenlists from serving the full term of his or her new commitment (or even reaching his or her original SEAOS). For example, a sailor whose initial SEAOS is in August might reenlist in April but suffer a career-ending injury in July. The commitment, rather than a

[7] Doing this in reverse—subtracting the pre-policy-change male-female difference in reenlistment rates from the post-policy-change male-female difference in reenlistment rates—yields the same result.

[8] We use initial SEAOS upon reaching the fleet to allow for changes in SEAOS between accession and reaching the fleet. Then, we count back 12 months to define the decision window.

sailor's ability to act on it, should be used to estimate the association between maternity leave length and the probability of reenlisting.[9]

Our sample and outcome measures exclude several types of sailors. First, we exclude sailors who committed before the 12-month decision window because they may be systematically different from those who commit later. These sailors are typically concentrated in specific enlisted management communities (EMCs), such as the nuclear EMCs, that provide an opportunity to reenlist at much earlier points in their careers. However, sailors in these EMCs who do *not* reenlist early may be disproportionately unlikely to ever reenlist. We therefore omit all sailors who ever served in an EMC where 10 percent or more reenlisted before our 12-month decision window.[10] We also exclude sailors who attrited without first reenlisting.[11]

Next, we restrict our analysis to sailors whose SEAOSs came within two specific periods:

1. Our **pre-policy-change group** consists of sailors with SEAOSs between September 2013 and June 2015, who had six weeks of maternity leave available during their decision window. While some of these sailors were retroactively eligible for an additional 12 weeks of maternity leave, they would not have known this until after they had reenlisted.
2. Our **post-policy-change group** consists of sailors with SEAOSs on or after July 2016; these sailors had at least 12 weeks of maternity leave available for their entire decision window.

We omit sailors with SEAOSs before September 2013 to limit possible differences between the pre- and post-policy-change groups that were clearly unrelated to the policy change. For example, we did not want to compare sailors who enlisted before the 2008–2009 financial recession with those who enlisted after. We also omit sailors with SEAOSs during the **phase-in period** between July 2015 and June 2016. These sailors had both 6-week and 18-week maternity leave policies in effect during their decision windows. For some, the 18-week policy would have been implemented too late to affect their reenlistment decisions. For example, a sailor whose SEAOS was in August 2015 would likely have made her reenlistment decision before July 2015. For others, the 6-week policy may have lapsed before they made a

[9] The precise timing of deciding to reenlist, committing to reenlist, and serving beyond one's initial SEAOS is both technical and beyond the scope of this paper. However, a 12-month decision window most likely covers the first two of these activities and encompasses career waypoint (C-WAY) rules and requirement timelines.

[10] Appendix D contains information on the relevant EMCs and the number of sailors affected by our sample refinement.

[11] Some forms of attrition, such as drug or alcohol abuse, may reflect on sailors' fitness for service. However, these sailors might still have chosen to serve their reenlistment *had they been able*. Sailors who attrite after reenlistment have indicated a choice and therefore remain in our data, though this may inflate our reenlistment counts.

reenlistment decision. Because we cannot observe for whom each policy was more relevant, we omit these sailors.

Finally, we omit several groups of sailors with observed behavior or characteristics that may make them systematically different from our larger sample. We omit sailors whom we do not observe reaching the fleet or whose length of service (LOS) upon first appearing in our data is greater than two months.[12] These exclusions allow us to examine a more uniform group of sailors with more representative responses to maternity leave policy changes. Appendix D contains a full list of sample restrictions, as well as of the number of sailors omitted under each.

We use data on a wide range of sailor characteristics in our analyses. These include race, Hispanic ethnicity, citizenship status, joint marital and colocation statuses, education, EMC group, age, promotion in the past 12 months, due for a promotion, medical accounting code in the past 12 months, demotion in the past 12 months, ever demoted, Armed Forces Qualification Test (AFQT) score, eligibility for an SRB in the previous 12 months, paygrade, and time in grade.[13] For SRBs, we compare the levels that were offered in each of the previous four quarters for the EMC and Navy Enlisted Classifications (NECs) held by the sailor. We select the maximum level in each quarter, and then choose the minimum of the four maxima.[14] Appendix D provides details on these control variables.

We estimate the diff-in-diffs model for all female sailors and then separately for female sailors with children and without children at SEAOS because the two groups may view maternity leave differently. For example, expanded maternity leave would not be materially relevant to women who had already reached their desired number of children. Furthermore, women without children might more explicitly weigh the implied trade-offs between children and career and might be more likely to be affected by maternity leave policies in the future.

Table 2 shows select summary statistics for both the full data sample and the restricted sample used in our analysis. Female sailors made up approximately a fifth of our initial sample and a quarter of our analytic sample. In both samples, they are more likely than male sailors to be black or Hispanic and less likely to be white. On average, women have lower AFQT scores than

[12] We note two reasons why sailors might have an LOS greater than two months at their first appearance in the data. First, it could reflect some amount of prior service, and we chose to restrict our analysis to non-prior-service sailors. Second, it could reflect data entry error. Dropping sailors because of random data-entry error in this case should not skew our estimates but may reduce their precision.

[13] Sailors with missing AFQT scores were assigned the mean AFQT score in our sample; we also include a variable for missing AFQT score that captures systematic deviations from the mean.

[14] For example, suppose a sailor held an EMC and NECs such that, over the course of a year, the corresponding SRB levels were 1 and 2 in the first quarter, 2 and 3 in the second quarter, 2 and 4 in the third quarter, and 3 and 4 in the fourth quarter. In that year, the *maximum* SRB levels were 2, 3, 4, and 4, for quarters one through four, respectively, and the *minimum* of these is 2.

men. Approximately a quarter of women in our analytic sample had children as of their initial SEAOS, but only 3.3 percent reported having any children at their first appearance in the data.

Table 2. Summary statistics for full data sample and restricted analytic sample

	Initial sample		Restricted sample	
Variable	Male	Female	Male	Female
American Indian/Alaska Native	4.6%	4.5%	3.6%	3.8%
Asian/Pacific Islander	5.6%	5.8%	6.4%	5.9%
Black	17.1%	24.8%	18.0%	26.1%
White	62.5%	52.9%	55.2%	45.7%
Other race	8.6%	10.1%	15.2%	16.8%
Unknown	1.7%	2.1%	1.6%	1.7%
Hispanic, any race	16.7%	19.7%	18.3%	21.3%
Age at first observation	20.9	20.8	21.3	21.0
(Standard deviation)	(2.9)	(2.9)	(3.0)	(3.0)
Average AFQT score	65.4	61.2	63.3	60.4
(Standard deviation)	(18.1)	(16.5)	(15.3)	(14.1)
N	413,098	102,248	29,205	10,254

Source: CNA estimates using EMF data.

In the following section, we show the results of applying diff-in-diffs methodology to the sample outlined above, both at a glance and when controlling for a variety of sailor characteristics.

Results

We begin by showing reenlistment rates for our sample before and after the policy change. We then show the results of a diff-in-diffs model that omits all control variables. Next, we present a more detailed version of the model that includes the full set of control variables described in the previous section and in Appendix D. Finally, we present a cost-benefit calculation that compares weeks of work lost because of additional maternity leave during a set 12-month period with weeks of work gained from additional reenlistments during that time.

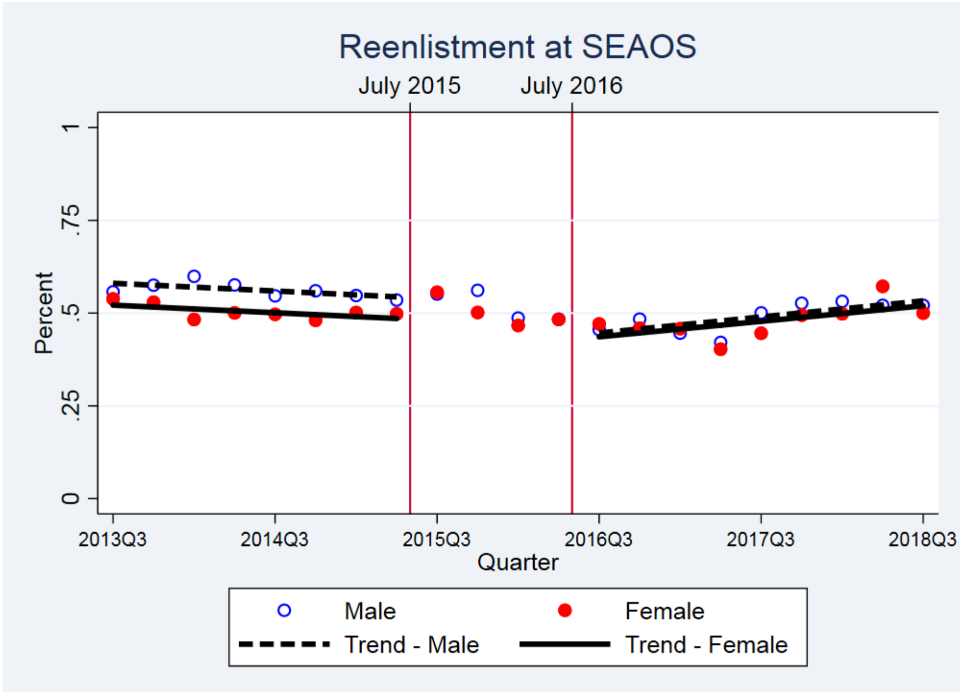
Reenlistment rates

Figure 3 shows how the reenlistment rate, which we define as reenlistments divided by reenlistments plus exits, varied by quarter for male sailors versus female sailors in our sample. Hollow blue and solid red circles show the reenlistment rates for the respective groups in each quarter, and dashed and solid lines show pre- and post-policy trends for the respective groups. Vertical lines indicate the end of the pre-policy-change period in July 2015 and the beginning of the post-policy-change period in July 2016.

Figure 3 shows that female sailors reenlisted at lower rates than male sailors during the pre-policy-change period, with a relatively even gap in reenlistment represented by the best-fit lines. In the post-policy-change period, this gap nearly vanishes. This graph supports the critical assumption that male and female reenlistment rates behaved similarly prior to the expansion of maternity leave, one of the main criteria needed for our diff-in-diffs model to produce results as accurate as possible.[15] Reenlistment rates varied from quarter to quarter because of other Navy policy decisions, sailor-specific factors, and random chance, but male and female reenlistment rates tended to rise and fall together before the expansion of maternity leave.

[15] See Appendix C for a discussion of this and other validity criteria.

Figure 3. Overall reenlistment by quarter



Source: CNA estimates using EMF data.

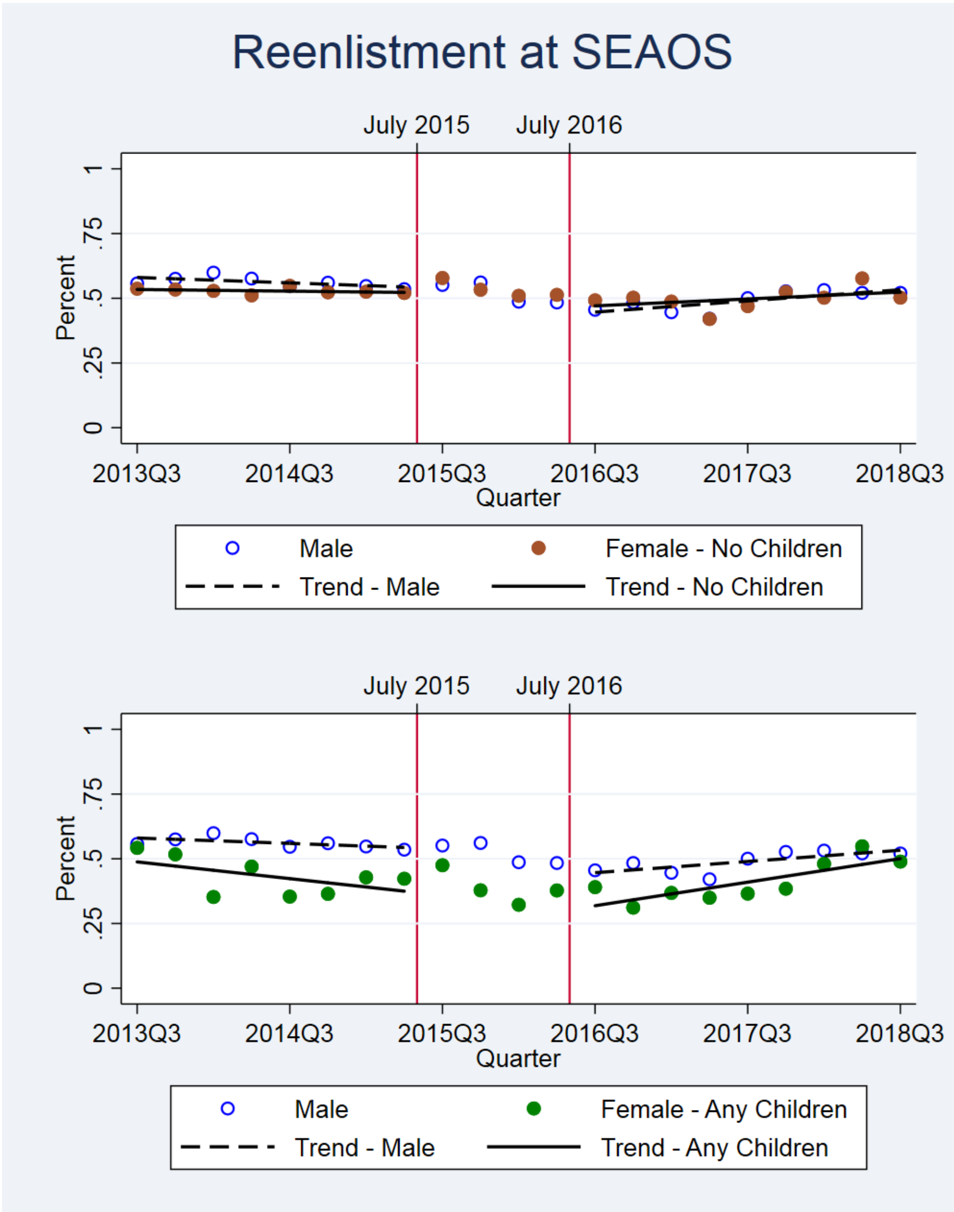
Figure 4 shows how reenlistment rates change when we separately consider women with and without children at their initial SEAOS. The top panel shows reenlistment rates for female sailors without children at initial SEAOS, and the bottom panel shows the reenlistment rates for female sailors with children at initial SEAOS, with each set of reenlistment rates compared with those for male sailors.

The top panel of Figure 4 shows patterns similar to those of Figure 3. Reenlistment rates trend similarly prior to the expansion of maternity leave, with female reenlistment rates consistently lower than male reenlistment rates, but the gap disappears after the policy has phased in.[16] In the bottom panel, however, the gap in reenlistment rates between male sailors and female sailors with children at initial SEAOS visibly (and statistically significantly) widens before the policy change (p-value = 0.023 when controls are omitted, 0.022 when included). This difference, along with the greater variability in reenlistment rates for female sailors with children, could invalidate any estimates for this group because an increase in their reenlistment rates could be attributable (a) to the policy, (b) to a bounce-back after a period of unexpectedly low reenlistment, or (c) to random noise. Although we present results for all

[16] While the pre-policy best-fit lines may not appear perfectly parallel in the top panel, the difference in slopes is statistically insignificant (p-value = 0.755 when controls are omitted, 0.535 when included).

three groups (women overall, women without children, and women with children), results for women with children should be treated with caution.

Figure 4. Reenlistment by quarter, separately for women with and without children at SEAOS



Source: CNA estimates using EMF data.

Diff-in-diffs model results

We present two sets of numeric results. The first shows changes in the reenlistment rate without controlling for sailor characteristics. This approach produces estimates that directly match the visual findings in Figure 3 and Figure 4. However, these results do not account for broad changes in background or service-related factors that affect male and female reenlistment differently (e.g., growth in high-turnover EMCs that disproportionately employ men versus women). We therefore present a second set of results that use regression analysis to adjust for these factors.

Not controlling for other factors

Table 3 shows the results of the basic diff-in-diffs model, without controlling for other factors that could explain some of the difference in reenlistment rates across gender and over time; these estimates summarize the differences shown in Figure 3. The first two rows show reenlistment rates in the periods before and after the policy change, respectively, by gender. They also show results for women by whether they had children at SEAOS. The third row shows the difference in percentage points (ppts) between the pre- and post-policy-change periods for each group. The fourth row shows how the difference in reenlistment rates over time for each group of female sailors compares with that for male sailors.

Table 3. Diff-in-diffs results not controlling for other factors

		Women		
	Men	All	No children	Any children
Pre-policy-change reenlistment rate	56.6%	50.4%	52.7%	43.9%
Post-policy-change reenlistment rate	47.9%	47.5%	49.8%	39.0%
Diff (post-policy - pre-policy)[a]	-8.7 ppts	-2.9 ppts	-2.9 ppts	-4.9 ppts
Diff-in-diffs (female diff - male diff)[a]		5.8 ppts	5.8 ppts	3.9 ppts

Source: CNA estimates using EMF data.

[a] The results for all women in the "diff" and "diff-in-diffs" rows do not necessarily need to be a weighted average of the results in the "no children" and "any children" columns if sample composition shifts over time. In this case, approximately 73.9 percent of women before the policy change had no children, while 78.7 percent of women after the policy change did.

Table 3 shows that male reenlistment started from a higher baseline than female reenlistment—particularly relative to women with children at initial SEAOS. Yet, while male reenlistment fell by 8.7 percentage points between the pre- and post-policy-change periods, female reenlistment fell by only 2.9 percentage points. Together, this shows that the female reenlistment rate rose by 5.8 percentage points relative to the male reenlistment rate, not controlling for other factors. Reenlistment among women without children at SEAOS also increased by approximately 5.8 percentage points relative to men, but reenlistment among women with children increased by only 3.9 percentage points.

Table 3, however, does not conclusively demonstrate that changes in maternity leave policy *caused* an increase in female sailors' reenlistment. Other factors could have affected female reenlistment rates differently than male reenlistment rates. For example, if the shares of male and female sailors in different EMCs changed over this period, the differences in reenlistment rates across those skill specialties—rather than maternity leave policy—might have driven some of these diff-in-diffs results. Although it is useful to see how the overall reenlistment rates for men and women changed before and after the policy change, we cannot use these results to associate reenlistment changes with any single factor.

We therefore present additional results that control for sailor characteristics to better isolate the impact of the change in maternity leave itself. While we cannot control for all sailor, service-wide, and external factors, and therefore cannot perfectly estimate the true causal impact of this policy, this approach limits the factors that could affect our results.

Controlling for other factors

Table 4 introduces other factors to the diff-in-diffs model, and we use linear regression to control for the effect of these factors on our diff-in-diffs estimates. Each column shows results for one regression, and each row shows the results for a specific variable. We report the coefficients for the female sailor indicator variable(s) (women overall in column 1, broken down by no children versus any children in column 2, and exclusively for female sailors without children at SEAOS in column 3), the post-policy-change indicator variable, and the female sailor indicator variable(s) interacted with the post-policy-change indicator variable. Appendix E contains the complete set of results.

The first set of rows in Table 4 shows that female sailors overall had reenlistment rates 2.2 percentage points lower than those of male sailors prior to the expansion of maternity leave, controlling for other factors. However, the results differ for women with and without children at SEAOS. We estimate that women without children were 1.5 percentage points less likely than male sailors to reenlist, while women with children at SEAOS were 4.6 percentage points less likely than male sailors to reenlist. The center row labeled "post-policy" shows that sailors, in general, were approximately 5.0 percentage points less likely to reenlist in the post-policy-change period, controlling for other factors.

Table 4. Diff-in-diffs results controlling for other factors

Variable	Women vs. men	Women with no children and with any children vs. men	Women with no children vs. men
Female			
All	-2.2 ppts ***a, b	-	-
No children	-	-1.5 ppts *	-1.2 ppts
Any children	-	-4.6 ppts ***	-
Post-policy	-5.0 ppts ***	-5.0 ppts ***	-5.0 ppts ***
Diff-in-diffs			
All	3.7 ppts ***	-	-
No children	-	3.6 ppts ***	3.7 ppts ***
Any children	-	3.4 ppts *	-
Adjusted R^2	0.1801	0.1802	0.1784
N	39,459	39,459	37,010

Source: CNA estimates using EMF data.
[a] The superscripts *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.
[b] Results in red are statistically significant and negative, results in green are statistically significant and positive, and results in black are statistically insignificant.

The last three rows of estimates show that expanding maternity leave was associated with an increase in female reenlistment rates. In particular, we estimate that female reenlistment rates increased by 3.4 to 3.7 percentage points, depending on whether we allow the estimates to differ for women with and without children. The estimates for women with children are notably less precise than those for women without children.

One potential concern with our estimates is that we use a short pre-policy-change period (i.e., September 2013 through June 2015) in order to satisfy our diff-in-diffs model's methodological requirements. Appendix F shows that, if we use different starting points for our pre-policy-change period, estimates for women without children at their initial SEAOS remain statistically significant but are reduced in magnitude. However, even the smallest of the estimates shows an increase in reenlistment rates of 2.2 percentage points for this group of female sailors relative to men. Note that estimates in Appendix F are much more sensitive to whether women are grouped by having children at SEAOS or not than are the estimates in Table 4.

Limiting our sample to 4YO sailors ensures that reenlistment decisions for our sample of sailors occur at comparable times in their Navy careers. However, this excludes about 52 percent of the first-term male sailor population and about 44 percent of the first-term female sailor population who have 5- or 6- year obligations (5YO and 6YO sailors). We estimated our diff-in diffs equations for 5YO and 6YO sailors only, but the parallel trends assumption was violated for nearly all of the samples, and the estimates for female 5YO and 6YO sailors without children were statistically insignificant.[17] We then applied the diff-in-diffs technique to a sample that includes 4YO, 5YO, and 6YO sailors. We estimate that, under certain strict assumptions about when reenlistment decisions occur for 5YO and 6YO sailors, 4YO, 5YO, and 6YO female sailors without children are 2.4 percentage points more likely to reenlist after the change in the maternity leave policy relative to men. These assumptions about the timing of reenlistment decisions for 5YO and 6YO sailors, however, likely undercount reenlistment rates. Appendix G contains more detail on the results for the sample of 4YO, 5YO, and 6YO sailors.

Cost-benefit calculations

Net effect on weeks of work

Based on our 4YO results, we can compute the change in the net number of weeks worked after the institution of expanded maternity leave. We assume that sailors' behavior did not otherwise change in response to the policy (e.g., that the additional maternity leave did not induce any sailors to have additional children).[18] In addition, this analysis focuses solely on the number of weeks worked, and it assumes that all weeks worked are of equal value to the Navy.

The cost of expanding maternity leave can be measured as weeks of work lost because of the new policy. The last 12 months for which we have birth data available are October 2016 through September 2017. During that time, there were 1,236 births to 4YO sailors. We assume that the October and November 2016 births fall under the final two months of the 18-week policy and the remaining births fall under the 12-week policy. We also assume that all sailors take the maximum amount of leave. The data show that 180 births are associated with 12 additional weeks of leave compared with the pre-policy-change period, and 1,056 births are associated with 6 additional weeks of leave, producing a total of 8,496 weeks of work lost in a year because of the increase in maternity leave.

[17] Overall, the women in the sample of 5YOs and 6YOs fail a test of the parallel trends assumption both when covariates are omitted and when they are included, as do women without children; women with children pass the test when covariates are omitted, but not when they are included.

[18] Even if the expanded maternity leave policies did not change any decisions by already-enlisted sailors, they might induce more enlistment by women overall, and disproportionately by women interested in having families. Exploring this is beyond the scope of this effort and will require more years of data to analyze.

The benefit of maternity leave consists of the additional reenlistment that takes place.[19] During October 2016 through September 2017, 4,412 4YO female sailors reached their SEAOS. Using the coefficient in the first column of Table 4, an additional 3.7 percentage points of reenlistment means that 164 sailors reenlisted who would not have done so before the policy change. If we assume that each sailor reenlists for 43 months[20] and that 48 weeks of every year are spent working, the increase in reenlistment rates provides an additional 28,208 weeks of work.[21]

Using average reenlistment commitments, there is an annual net gain of almost 20,000 weeks of work associated with the increase in maternity leave. In reality, our estimates may not reflect the true effect of maternity leave; however, note that, as long as the true size of the association between the increase in maternity leave and reenlistment rates is 30 percent of our estimate or greater, the policy change would still result in a net gain in weeks of work.[22]

Considerations for the impact on sea duty

It is more challenging to assess the readiness impact of an increase in maternity leave than it is to determine the net effect on weeks of work. For instance, although we can observe the EMC and paygrade of sailors who become pregnant, we cannot make any statement about the effect of a longer maternity leave policy on productivity. However, we can observe whether those sailors are on sea duty or shore duty.

Navy policy dictates that sailors who become pregnant while assigned to sea duty must be reassigned to shore duty by the 20th week of pregnancy. Typically, commands ask to have

[19] For purposes of comparing the weeks of work lost and gained, we effectively assume that our estimate of the increase in female reenlistment rates was *caused by* the policy change. We do this because we have no other estimate of the behavioral response to the policy change and no other explanation for why female reenlistment rates rose from the pre- to the post-policy-change period relative to male rates. The weeks-of-work comparison should be revisited if a better estimate of the behavioral response to the policy change is developed or another explanation for the relative changes in male and female reenlistment rates is discovered.

[20] This is the average number of months by which contract length is increased among 4YO women at initial SEAOS who reenlist (which we define as increasing their service obligation for at least an additional 24 months). While this number does not account for early exits, it also does not include subsequent reenlistments at the new SEAOS. Since sailors attrite relatively rarely after their first reenlistment, actual additional time served is therefore unlikely to be substantially below 43 months.

[21] We are unable to estimate how long sailors who reenlist during this timeframe remain in the service, as their reenlistment period extends beyond the present day. Some women will not serve for the full 43 months because of attrition, while others may work for fewer weeks per year than anticipated because of (re)taking maternity leave during this period. However, we anticipate that even taking these circumstances into account, the average length by which servicewomen's careers are extended by reenlistment will be greater than 43 months.

[22] Every estimate associated with the robustness checks that we performed for the model exceeds the 30 percent figure. For more information on our robustness checks, see Table 9 in Appendix F.

these sailors reassigned to shore as soon as the pregnancy is verified so that requisitions for replacement sailors can be submitted. After sailors give birth, they are granted one-year operational deferments during which they are assigned to shore duty [5].[23] Thus, sailors who become pregnant are assigned to shore duty for approximately a year and a half surrounding the birth. Depending on the amount of time left on their contracts at the end of the operational deferment period, these sailors may be assigned to sea duty again to finish uncompleted sea tours. Sailors who become pregnant while assigned to shore duty may also be assigned to sea duty upon completion of the operational deferment period, depending on the sea-shore rotation policy for the particular EMC and the length of time remaining on the contract. Thus, sea duty can be curtailed for sailors who become pregnant while on sea duty and can be delayed for those who become pregnant while assigned to shore duty.

Since Navy assignment policy already dictates that pregnant sailors are assigned shore duty for about 18 months surrounding the birth, no sea duty is lost as a first-order effect of lengthening maternity leave. Using other CNA studies and EMF data, however, we can make a rough estimate the amount of sea duty lost to pregnancy, net of sea duty gained as the result of the additional reenlistment associated with longer maternity leave. To accomplish this, we take the following steps:

- We use an estimate (from an earlier CNA study [6]) of the annual number of women who became pregnant while assigned to sea duty and the average amount of sea duty time lost due to early rotation.
- We use DHA birth records and EMF personnel records to make a rough estimate of the annual number of women who become pregnant while assigned to shore duty and the average amount of time that rotation back to sea is delayed due to pregnancy/ operational deferment.
- We use our estimates of the annual number of additional reenlistments that the longer maternity leave policy is expected to produce and the average length of the first reenlistment period described in the previous subsection. We use EMF records to estimate the average amount of time spent on sea duty in the first reenlistment period.

We estimate that about 98,100 sea duty weeks are lost or delayed annually due to pregnancies of first-term sailors. We also estimate that the increased maternity leave reduces the annual sea duty weeks lost/delayed by approximately 7,000 weeks, or about 7 percent. See Appendix H for more details on our calculations and assumptions.

[23] Exceptions may be granted on a case-by-case basis; for example, a sailor may request to return to sea duty early, or to finish ongoing sea duty, if it would be operationally advantageous and pose little risk to herself or the child.

Limitations

Three limitations may lessen the impact of our findings. The first limitation is that we do not observe all policies or control factors that might affect male and female reenlistment rates differently. Although we have controlled for a wide variety of sailors' demographics and Navy career characteristics, other unobserved factors may be correlated with reenlistment decisions and/or with other observable factors in a diff-in-diffs model. Nevertheless, our model estimates are consistent across many subsamples and combinations of control factors beyond those reported here.

The second limitation is that sufficient data do not exist to examine the impact of the change to 12 weeks of maternity leave separately from the change to 18 weeks. If we were to create a new diff-in-diffs model that used the same pre-policy period but defined the post-policy period as beginning 12 months after the *announcement* of the 12-week policy, we would have only seven quarters in the post-policy period with which to estimate the relationship between the increase in maternity leave and reenlistment rates. If the post-policy period began 12 months after *all births* qualified for 12 weeks of leave, this would reduce our post-policy period to three quarters.

Moreover, the third limitation is that the proximity of the two policy changes makes it difficult to estimate their effects separately. Women in our post-policy period had at most two quarters in which an 18-week maternity leave policy actually applied; for most of this time, the 12-week policy was in effect. Even if we expanded the post-policy period to include part of the phase-in period, there would be too few quarters in the 18-week policy to cleanly measure the separate impacts of each policy.

Conclusions and Implications

In this paper, we examine how the use of maternity leave changed with DON's expansion of leave in 2015 and how female sailors' reenlistment rates changed before and after the policy shift relative to male sailors' reenlistment rates. We find that allowing additional leave led to increases in actual leave taken, with the median sailor taking the full amount of leave permitted.

Moreover, we find that female 4YO sailors' reenlistment rates increased by 3.7 percentage points relative to those for men after controlling for a wide range of demographic and career characteristics. We find that results are stronger for female sailors who did not have children at their initial SEAOS, perhaps because these sailors are more explicitly weighing maternity leave as a factor in their career and family goals. This group tends to drive our findings across a wide range of alternative model specifications because it represents the bulk of the female sample and consistently has both larger and more precisely estimated results. Note that our methodology does not allow us to say conclusively that the increase in maternity leave *caused* a change in reenlistment rates. Instead, we show the difference in reenlistment rates across two time periods after accounting for the possible impact of a wide range of factors, while allowing that other, unobservable ones might still be able to influence our findings.

Despite some concern that increasing the amount of maternity leave could reduce net weeks worked, thereby potentially increasing the personnel costs needed to maintain readiness, we find that the reduction in weeks worked because of expanded maternity leave use is considerably smaller than the average number of weeks gained in an additional reenlistment. In fact, there would be a positive effect on net weeks of work even if the true relationship between the increase in maternity leave and reenlistment rates were a third the size of those reported here.

The main implication of our work is that policies aimed at retaining women—or any subgroup of sailors in the Navy—that may appear to be a net cost to the personnel system at first glance may, in fact, be cost effective. Furthermore, such policies do not need to have very large effects to justify their costs. If expanding maternity leave is associated with an additional 100 reenlistments per year and birth rates hold constant at their current level, it will produce a substantial net increase in total hours worked.

Regardless of the change in maternity leave policy, we find that some sailors had no maternity-specific leave recorded in the period surrounding birth, and some had very little recorded leave of any sort during that time. We find that loss from the Navy and use of other types of leave do not fully explain this absence of recorded leave taken around the birth of a child. These instances occur frequently enough to warrant further investigation: does data entry error account for this anomaly, or is there some other explanation?

This study could be expanded in several ways. For example, we could perform the same analysis in a few years, and the additional data could allow us to examine the 12-week policy specifically. We could also assess whether the relative increase in female reenlistment rates holds steady in the future. Future analysis could help determine if the increase in female reenlistment rates that we have observed so far might be a temporary boost that fades as 12 weeks of maternity leave become the "new normal." It would also be useful to examine whether expanded maternity leave has attracted more women to the Navy. It is possible that expanded maternity leave could increase the number of weeks worked through initial enlistment as well as reenlistment.

Appendix A: Maternity Leave and Civilian Labor Market Outcomes

Because the United States does not have federally established paid maternity/family leave, research into the effects of paid family leave focuses on either state-level leave policies or leave policies in other countries. Much of the research on state-level policy focuses on California, which in 2004 became the first state to establish paid parental leave not specifically related to recuperation from childbirth.[24] After California instituted a six-week paid leave policy, average leave taken increased by about three weeks, as did women's employment in the 9 to 12 months after birth and hours and weeks worked during the second year after birth [7]. Nonwhite women, women with a high school degree or less, and unmarried women all used less leave than their counterparts before the policy change but increased their leave-taking by greater amounts after the policy went into effect [8]. Despite the short-term reduction in employment, women's employment increased in the medium term [8]. Large majorities of employers reported that the law had positive or neutral effects on productivity, profitability and performance, employee turnover, and morale [9]. CNA analysis of nationwide, employer-specific paid maternity leave policies showed that both the existence and length of paid maternity leave were correlated with higher retention after giving birth, particularly among women younger than 30; however, this analysis acknowledged that maternity leave may be correlated with other factors that improve retention, such as pay, benefits, or work environment [10].

Studies based on foreign parental leave policies focus on the total amount of leave available or how well it is compensated. In Canada, increases in the amount of available leave (paid at 50-55 percent of wages, with total payouts capped at roughly the average weekly wage) led to more time away from work after giving birth but increased continuity with the same employer [11]. In Germany, several (fully paid) parental leave increases led to longer spells of leave being taken but did not substantially affect longer term employment rates or labor market income; however, extending maternity leave past the point where a woman is guaranteed her original position or an equivalent may have hurt women's longer term employment and earnings [12]. In Japan, increasing the wage replacement rate (from 0 percent to 25 percent in 1995 and from

[24] Hawaii, Puerto Rico, and the District of Columbia provide paid maternity leave by defining childbirth as a temporary disability and allowing new mothers to collect temporary disability insurance. California's policy is specifically to allow parents to bond with their children and is in addition to a temporary disability insurance policy; New Jersey, New York, and Rhode Island have since established leave policies that combine a disability element and a caregiver element. In 2007, the State of Washington passed a family leave law, but, without a funding mechanism, it has not gone into effect.

25 percent to 40 percent in 2001) while holding the duration of paid leave and job protection constant appeared to have no effect on job continuity [13]. In Organization for Economic Cooperation and Development (OECD) countries, maternity leave policies of up to a year usually can increase employment and job continuity, but longer periods of maternity leave can harm earnings, employment, and career advancement [14].

Results from the civilian labor market might not be relevant to the Navy for several reasons. The Navy has a fundamentally different employment structure than most workplaces. Sailors are expected to serve out comparatively long contracts relative to civilian employees, who are typically not required to stay with an employer for any set length of time. For many female sailors, whether they return to work after giving birth is (at least in theory) a moot question. Instead, intentional changes in employment status would be reflected in the decision to reenlist.[25] In addition, female sailors are demographically and socioeconomically different from most of the groups studied in the analyses cited above. For example, a female sailor randomly selected from our data is less likely to be Asian or Hispanic, more likely to be Black, and less likely to have a college degree than a randomly selected Californian in 2018.[26] Also, in the case of the studies conducted outside the US, the duration of maternity leave that female employees are allowed is substantially longer than is allowed for female sailors.

[25] There is some sailor attrition due to pregnancy or motherhood, but exploratory analyses did not reveal statistically significant changes in overall attrition when maternity leave was first expanded, possibly because the attrition rate was so low to begin with.

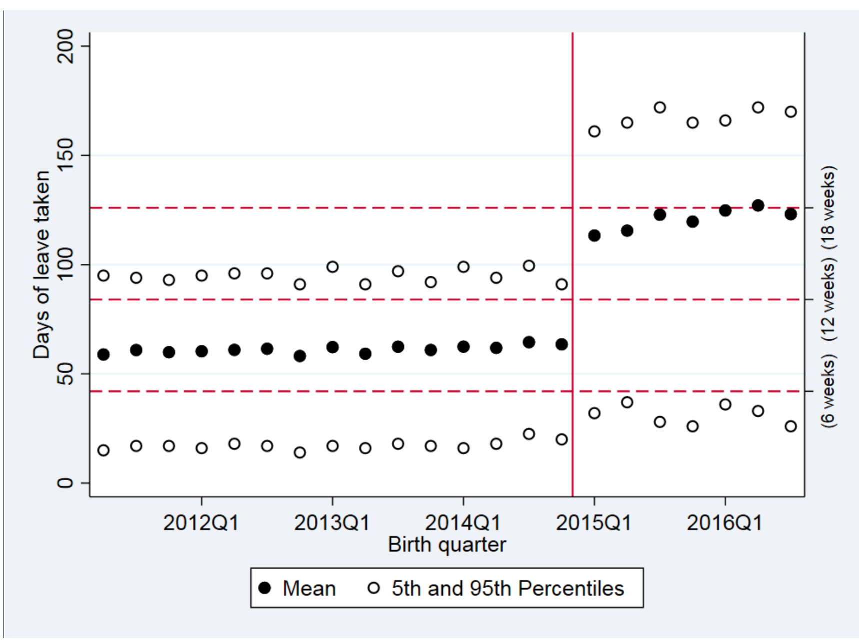
[26] Based on Census data from https://www.census.gov/quickfacts/fact/table/ca/EDU635217#EDU635217, accessed Feb. 2, 2019.

Appendix B: Leave Taken by Sailors Around Childbirth

Figures 4 and 5 summarize total days of leave taken over an interval beginning 30 days before and ending one year after first childbirth, for all first births between April 1, 2011, and September 30, 2016. Data points are aggregated by reporting quarter. The solid vertical line represents the beginning of the 18-week policy, while the dashed horizontal lines represent the amount of convalescence and/or maternity leave available under each policy.

Figure 5 shows convalescence, maternity, ordinary, separation, and emergency leave taken by all sailors who gave birth. Adding in ordinary, separation, and emergency leave to convalescence and maternity leave necessarily increases the amount of leave taken in both the pre- and post-policy-change periods relative to that shown in Figure 2. The increase is greater in the period before 2015 Q1, suggesting that increased maternity leave may have reduced the need to use other forms of leave. However, because total leave taken still increases sharply in 2015 Q1, the additional maternity leave represents new net leave.

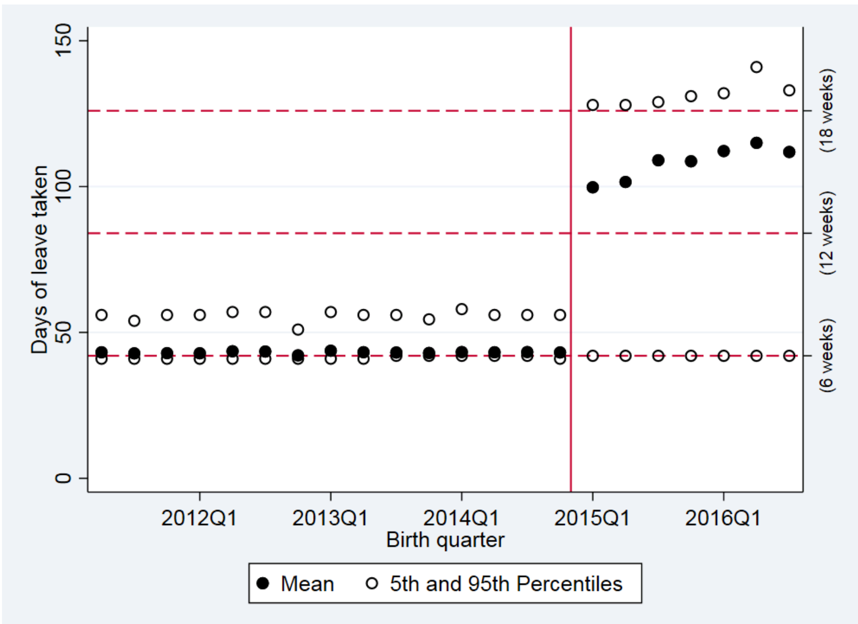
Figure 5. Total days of all types of leave taken around childbirth



Source: CNA calculations of leave reported in the Navy e-leave system for sailors who have a reported birth in DHA medical claims data, including sailors who report no leave taken.

Figure 6 shows how maternity and convalescence patterns are affected when we omit sailors who took neither of those types of leave around childbirth.

Figure 6. Total days of all types of leave-taking around childbirth, excluding sailors who took no leave



Source: CNA calculations of reported leave from the Navy e-leave system for sailors who have a birth reported in DHA medical claims data, excluding sailors who report no leave taken.

The graph shows the fifth percentile of leave holding steady at 42 days on either side of the policy cutoff and mean leave at 42 days prior to the policy. This, in combination with Figure 2, implies that women who took any leave were very likely to take (at least) 42 days of leave. After the 18-week policy went into effect, however, the average amount of leave taken did not jump to the full 126 days (18 weeks). Given the wider range of days, there were more options for women to take different amounts of leave. Nevertheless, the most common amount of leave taken was the full 126 days (42.3 percent of positive leave-takers), with another 12.6 percent of leave-takers within 3 days of this amount. The two next-most-common amounts of leave taken were 42 days (6.5 percent) and 84 days (5.12 percent). These nine values together account for nearly two-thirds of leave taken. Therefore, it appears that most women took leave in 6-week intervals, with scattered amounts of leave between these values.

Appendix C: Diff-in-Diffs Requirements and Formal Model

Diff-in-diffs requirements

For diff-in-diffs estimation to reflect the statistical association of a policy change (e.g., lengthening maternity leave) with changes in the outcomes of interest (e.g., reenlistment rates), four assumptions must hold:

1. Treatment and comparison group outcomes need to have parallel trends before the policy shift. In our case, female and male reenlistment rates do not have to be equal before the treatment (i.e., the policy change), but they must be trending in a similar manner. For example, the parallel trends assumption would be violated if female reenlistment rates were increasing and male reenlistment rates were decreasing before the policy change. Such a violation could result in a positive diff-in-diffs estimate that might simply reflect existing reenlistment rate trends.
2. Treatment status cannot be determined by the outcome. In our context, this means that sailors cannot be assigned different amounts of maternity leave based on their propensity to reenlist. In the Navy, all female sailors became eligible for additional maternity leave at a single point in time regardless of how likely they were to reenlist, so this requirement is met.
3. The composition of the treatment and comparison groups should be stable over time. For example, suppose male sailors were more likely to serve in EMCs with high loss rates in the pre- versus post-policy-change period. If we do not properly control for the change in the distribution of sailors across EMCs over time, we could misattribute its effect on reenlistment rates to the change in maternity leave policy. To ensure as much as we are able that this assumption holds, we include a wide range of control factors covering sailor demographics and Navy career characteristics in our analysis. It is possible, however, that the effect of other unobservable factors could be misattributed to the change in maternity leave policy.
4. There cannot be any spillover effects, or behavioral responses to the policy change, among unaffected groups. We structured our pre- and post-policy-change groups so that women with SEAOSs in the pre-policy-change period could not have had their reenlistment decisions affected by the expanded maternity policy. In addition, we omit men with military spouses from our model because they likely benefited from the expanded leave in ways that men with nonmilitary spouses did not. We assume that

men without military spouses did not modify their reenlistment decisions on any systematic scale because of changing maternity leave policies.

Even if these assumptions all hold, other factors could harm the interpretability of our estimates. One such factor is mean regression. For example, if female reenlistment rates were unusually low and/or male reenlistment rates were unusually high prior to implementation of the policy, the mere return to normal (or mean) levels could be mistaken for a change associated with the policy shift. In addition, there may be omitted factors that affected both the shift in maternity leave policy and the change in female reenlistment rates. For example, we cannot rule out that shifting cultural and institutional attitudes toward working motherhood and women's military service might affect both maternity leave policies and specific women's reenlistment decisions.

Formal model

In its most basic form, a difference-in-differences estimator can be computed as:

$$\widehat{DD} = \left(\overline{x_{f1}} - \overline{x_{f0}}\right) - \left(\overline{x_{m1}} - \overline{x_{m0}}\right)$$

where $\overline{x_{gt}}$ is the average reenlistment rate for gender $g \in \{m, f\}$ at time $t \in \{0,1\}$. This structure measures the change in female reenlistment and compares it against the change in male reenlistment. The difference in these changes is our diff-in-diffs estimator. Note that it would be mathematically equivalent to rewrite this as $\left(\overline{x_{f1}} - \overline{x_{m1}}\right) - \left(\overline{x_{f0}} - \overline{x_{m0}}\right)$, framing the estimate as the change in gender reenlistment gaps over time.

Of course, a simple comparison of averages ignores that male and female sailors have different demographic backgrounds, EMCs, AFQT scores, and other characteristics. We therefore use ordinary least squares regression to estimate the equation

$$y_i = \boldsymbol{X_i\beta} + \gamma_1 * female_i + \gamma_2 * post_i + \delta * (female_i * post_i) + \varepsilon_i$$

where y_i is a $0/1$ reenlistment decision for sailor i, $\boldsymbol{X_i}$ is a vector of sailor i's characteristics other than gender, $female_i$ is a binary variable taking on a value of 1 if sailor i is female, $post_i$ is a binary variable taking on a value of 1 if sailor i is in the post-policy period, and ε_i is a mean-zero error term. Here, γ_1 represents the difference between female and male reenlistment irrespective of time, γ_2 represents the difference in reenlistment after policy implementation relative to before irrespective of gender, and represents any additional post-policy changes in reenlistment that accrued specifically to women.

Appendix D: Sample Selection and Control Factors

Table 5 lists the concrete steps taken to create our analytic sample and describes how each step affected the size of the sample. The reasons for omitting sailors are listed in the order in which they occur, so we do not observe all reasons for which any particular sailor might have been dropped.

Table 5. Reasons for omitting sailors from the sample

	Male		Female	
Reason for omission	Number omitted	Number remaining	Number omitted	Number remaining
Initial sample	-	**413,098**	-	**102,248**
Not 4YO	217,591	195,507	46,540	55,708
Initial SEAOS before Sept. 2013	111,789	83,718	26,069	29,639
SEAOS (incl. ≤6 month ext.) after Sept. 2018	26,052	57,666	9,375	20,264
Initial SEAOS during "phase-in"	11,172	46,494	3,880	16,384
Didn't (yet) reach fleet	64	46,430	42	16,342
LOS >2 months at first appearance	2	46,428	3	16,339
Ever in EMC with ≥10% early reenlistment[a]	1,554	44,874	806	15,533
No observable outcome[b]	314	44,560	117	15,416
LOS ≤ 35 months one year prior to SEAOS	4,990	39,570	1,912	13,504
Outcome >12 months before SEAOS	1,850	37,720	762	12,742
Attrition or extension of 6 to 24 months	7,105	30,615	2,469	10,273
Both reenlistment and SEAOS loss reported	1	30,614	0	10,273
Male with military spouse	1,354	29,260	0	10,273
Paygrade E-6	55	**29,205**	19	**10,254**

Source: CNA tabulations from the EMF.

[a] See Table 6 for the list of the EMCs that fall into this category.

[b] Sailors in this category did not reenlist, extend their enlistment, adjust their enlistment, or exit the Navy at any point before SEAOS.

The EMCs in which at least 10 percent of the sailors make early reenlistment decisions are listed in Table 6.

Table 6. EMCs with at least 10 percent of sailors who reenlist early

EMCs
Aviation Structural Mechanic – Safety Equipment – Aircrew (AMENAC)
Aerographer's Mate (AG)
Legalman (LN)
Yeoman (YN)
Electronics Technician, Submarine Warfare (ETS)
Electrician's Mate, NucPow, Submarine (EMNUCSS)
Electrician's Mate, NucPow, Surface Warfare (EMNUCSW)
Electronics Technical, NucPow, Submarine (ETNUCSS)
Electronics Technical, NucPow, Surface Warfare (ETNUCSW)
Machinist's Mate, NucPow, Submarine (MMNUCSS)
Machinist's Mate, NucPow, Surface Warfare (MMNUCSW)
Engineering Lab Technician, Submarine (ELTNUCSS)
Engineering Lab Technician, Surface (ELTNUCSW)
SEAL, Special Warfare (SO)
Hospital Corpsman (HM), Biomedical Equipment Technician, Advanced (HMBMEST)
HM, Medical Laboratory Technician, Advanced (HMLABA)
HM, X-Ray Technician, Advanced (HMXRAYA)
HM, Special Operations Technician (HMXRAYA)
HM, Physical Therapy Technician (HMPT)
HM, Medical Deep Sea Diving Technician (HMDIV)
HM, Cardiovascular Technician (HMCP)
HM, Bio-Med Technician (HMBMET)
HM, Nuclear Medicine Technician (HMNUC)
HM, Urology Technician (HMGU)
HM, Orthopedic Cast Room Technician (HMCAST)
HM, Histopathology Technician (HMHISTO)
HM, Respiratory Therapy Technician (HMRT)
HM, Ocular Technician (HMOCC)
HM, Otolaryngology Technician (HMENT)
HM, Radiation Health Technician (HMRADHLT)
HM, Dental Laboratory Technician, Basic (DTLABB)
HM, Dental Laboratory Technician, Advanced (DTLABA)
HM, Dental Surgical Technologist (DTSURG)
HM, Dental Hygienists (DTHYG)

Source: CNA tabulations from the EMF.

Following are definitions of the variables we use in our model:

- Race is characterized as American Indian/Alaska Native, Asian/Pacific Islander, black, other race, or unknown, with white as the omitted category. We also include a variable for Hispanic ethnicity regardless of race.
- Citizenship is characterized as US national or noncitizen nonnational, with citizen as the omitted category.
- Joint marital status and colocation are coded as nonmilitary spouse; military spouse, noncolocated; military spouse, colocated; or military spouse, colocation unknown. Single is the omitted category.
- Education groupings are coded as non-high-school (non-HS) graduate, certificate; other alternative degree, certificate, or diploma;[27] HS graduate with some college; associate's; bachelor's+; and unknown. HS graduate is the omitted category.
- The following codes are used for EMC groups: Administration, Air Crew, Cryptologic Technician (other than Interpretive), Cryptologic Technician Interpretive, Diver, Intelligence, Master at Arms, Medical, Nuclear, General Detail, Seabee, Special Warfare, Submarine, Supply, Surface OPS, Surface Engineer, and Other/Unknown. Aviation Maintenance is the omitted category.
- Reenlistment incentives are accounted for with two variables. The first captures whether a sailor had any SRB in the 12 months before SEAOS. The second computes the maximum SRB over each of the four quarters before SEAOS and then uses the smallest of those four values (treating no SRB as a value of zero). This sets a floor for what each sailor might earn as a reenlistment bonus, while still allowing each sailor to choose the maximum possible SRB that he or she qualifies for at any given moment.
- Paygrade is coded as E-1, E-2, E-3, and E-5, with E-4 as the omitted category.

Although changes in the economy over time might affect male and female reenlistment decisions differently, we do not adjust for trends within the pre- and post-policy-change periods or otherwise control for the strength of the economy. When we included these variables in tests of the model, they made the post-policy-change indicator difficult to interpret while having a negligible impact on our diff-in-diffs estimates. Similarly, removing SRB and EMC group variables and replacing them with specific EMC code indicators has little effect on our estimates. Therefore, in this report, we present results that exclude explicit measures of changes in the economy and include EMC and SRB group variables.

[27] This group includes "Completed One Semester of College [as a non-HS graduate or alternative HS credential holder]," "Adult Education Diploma," and "First Year College Level of Education Certificate Equivalency."

Appendix E: Complete Estimation Results

Table 7 shows the complete set of regression results for our diff-in-diffs model. The first output column shows the results for the model comparing all men and all women, regardless of whether women had children at SEAOS. The second output column displays the results of the model comparing men and women, including a variable indicating whether the women had children. The third output column shows the results of the model comparing men and women without children. The parameter estimates are displayed with the standard errors in parentheses below. Parameter estimates appended by ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 7. Diff-in-diffs model results

Variable	Women vs. men[a]	Women with no children and with any children vs. men[a]	Women with no children vs. men[a]
Race			
Native American/ Alaska Native	-0.0154	-0.0156	-0.0123
	(0.0124)	(0.0124)	(0.0128)
Asian/Pacific Islander	0.1047 ***	0.1044 ***	0.1009 ***
	(0.0100)	(0.0100)	(0.0103)
Black	0.1663 ***	0.1665 ***	0.1632 ***
	(0.0063)	(0.0063)	(0.0065)
Other	0.0517 ***	0.0517 ***	0.0526 ***
	(0.0066)	(0.0066)	(0.0068)
Unknown	0.0193	0.0190	0.0242
	(0.0182)	(0.0182)	(0.0187)
Hispanic, any race	0.0192 ***	0.0192 ***	0.0189 ***
	(0.0059)	(0.0059)	(0.0061)
Citizenship status			
National	0.2565	0.2636	0.3527 *
	(0.1714)	(0.1715)	(0.2029)
Noncitizen nonnational	0.0216	0.0214	0.0258
	(0.0182)	(0.0182)	(0.0187)
Marital status			
Nonmilitary spouse (non-MS)	0.0587 ***	0.0601 ***	0.0638 ***
	(0.0050)	(0.0050)	(0.0052)
MS, noncolocated	-0.0967 ***	-0.0915 ***	-0.1119 ***
	(0.0239)	(0.0240)	(0.0295)

Variable	Women vs. men[a]	Women with no children and with any children vs. men[a]	Women with no children vs. men[a]
MS, colocated	-0.0504 ***	-0.0410 ***	-0.0745 ***
	(0.0143)	(0.0147)	(0.0195)
MS, colocation unknown	-0.0536	-0.0472	-0.0323
	(0.0236)	(0.0237)	(0.0299)
Education group			
Non-HS grad	-0.0108	-0.0116	-0.0050
	(0.0746)	(0.0746)	(0.0768)
Certificate	-0.0018	-0.0017	-0.0031
	(0.0208)	(0.0208)	(0.0215)
Other alt. degree, cert., or diploma	-0.0212	-0.0211	-0.0246 *
	(0.0141)	(0.0141)	(0.0145)
HS degree w/college	-0.0385 *	-0.0384 *	-0.0284
	(0.0230)	(0.0230)	(0.0237)
Associate's	-0.0829 ***	-0.0830 ***	-0.0864 ***
	(0.0131)	(0.0131)	(0.0136)
Bachelor's+	-0.1427 ***	-0.1428 ***	-0.1410 ***
	(0.0120)	(0.0120)	(0.0124)
Unknown	0.1367	0.1356	0.1369
	(0.1432)	(0.1432)	(0.1433)
EMC group			
Admin	0.1204 ***	0.1208 ***	0.1263 ***
	(0.0146)	(0.0146)	(0.0152)
Air Crew	-0.0964	-0.0958	-0.0983
	(0.1101)	(0.1100)	(0.1101)
Crypto	0.0057	0.0059	0.0107
	(0.0089)	(0.0089)	(0.0091)
CTI	-0.0716	-0.0733	-0.0734
	(0.0948)	(0.0948)	(0.0948)
Diver	0.1171	0.1176	0.1162
	(0.2026)	(0.2026)	(0.2027)
Intel	0.0231	0.0261	0.0513
	(0.0805)	(0.0805)	(0.0876)
MA	0.0470 ***	0.0473 ***	0.0512 ***
	(0.0097)	(0.0097)	(0.0100)
Medical	0.1861 ***	0.1857 ***	0.1713 ***
	(0.0329)	(0.0329)	(0.0339)
GenDet	-0.0502	-0.0502	-0.0517
	(0.0564)	(0.0564)	(0.0602)
Seabee	-0.0210	-0.0216	-0.0006
	(0.0592)	(0.0592)	(0.0603)

Variable	Women vs. men[a]	Women with no children and with any children vs. men[a]	Women with no children vs. men[a]
Sp Wrfr	0.3512 **	0.3515 **	0.3525 **
	(0.1712)	(0.1712)	(0.1714)
Sub	0.1159 ***	0.1161 ***	0.1141 ***
	(0.0165)	(0.0165)	(0.0166)
Supply	0.0628 ***	0.0632 ***	0.0624 ***
	(0.0085)	(0.0085)	(0.0089)
Surf OPS	-0.0826 ***	-0.0821 ***	-0.0794 ***
	(0.0076)	(0.0076)	(0.0078)
Surf Eng	-0.0909 ***	-0.0905 ***	-0.0924 ***
	(0.0069)	(0.0069)	(0.0071)
Age in months	0.0013 *	0.0014 *	0.0013
	(0.0008)	(0.0008)	(0.0008)
Age in months, squared	0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)
Promoted in past 12 months	-0.0067	-0.0068	-0.0102
	(0.0083)	(0.0083)	(0.0086)
Due for promotion	0.2912 ***	0.2900 ***	0.2856 ***
	(0.0243)	(0.0243)	(0.0247)
Medical accounting code	-0.3390 ***	-0.3399 ***	-0.3424 ***
in past 12 months	(0.0249)	(0.0249)	(0.0264)
Demoted in past 12 months	0.1014 ***	0.1003 ***	0.0982 ***
	(0.0249)	(0.0249)	(0.0253)
Ever demoted	0.0668 ***	0.0664 ***	0.0719 ***
	(0.0151)	(0.0151)	(0.0155)
AFQT score	-0.0001	-0.0001	0.0000
	(0.0012)	(0.0012)	(0.0012)
AFQT score, squared	0.0000 **	0.0000 **	0.0000 **
	(0.0000)	(0.0000)	(0.0000)
Missing AFQT score	0.0253	0.0308	0.2725
	(0.2615)	(0.2615)	(0.3205)
Any SRB in past 12 months	0.0871 ***	0.0873 ***	0.0855 ***
	(0.0058)	(0.0058)	(0.0060)
Minimum over past 4 quarters	-0.1142 ***	-0.1142 ***	-0.1113 ***
of highest quarterly SRB[b]	(0.0076)	(0.0076)	(0.0078)
Paygrade			
E-1	-0.5010 ***	-0.4959 ***	-0.4824 ***
	(0.1619)	(0.1619)	(0.1731)
E-2	-0.5945 ***	-0.5934 ***	-0.5926 ***
	(0.0376)	(0.0376)	(0.0382)
E-3	-0.4502 ***	-0.4489 ***	-0.4521 ***
	(0.0107)	(0.0107)	(0.0113)

Variable	Women vs. men[a]	Women with no children and with any children vs. men[a]	Women with no children vs. men[a]
E-5	0.2574 ***	0.2566 ***	0.2602 ***
	(0.0060)	(0.0060)	(0.0062)
Time in grade	0.0053 ***	0.0053 ***	0.0056 ***
	(0.0009)	(0.0009)	(0.0009)
Time in grade, squared	0.0000 **	0.0000 **	-0.0001 ***
	(0.0000)	(0.0000)	(0.0000)
Female			
Overall	-0.0223 ***	-	-
	(0.0079)		
No children	-	-0.0155 *	-0.0120
		(0.0086)	(0.0087)
Any children	-	-0.0458 ***	-
		(0.0137)	
Post-policy	-0.0502 ***	-0.0502 ***	-0.0498 ***
	(0.0055)	(0.0055)	(0.0055)
Diff-in-diffs			
Overall	0.0372 ***	-	-
	(0.0104)		
No children	-	0.0360 ***	0.0366 ***
		(0.0116)	(0.0116)
Any children	-	0.0336 *	-
		(0.0192)	
N	0.1801	0.1802	0.1784
Adjusted R^2	39,459	39,459	37,010

Source: CNA estimates using EMF data.

[a] The superscripts ***, **, and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

[b] It may appear unintuitive that higher SRBs are associated with lower retention. All else equal, more pay should lead sailors to reenlist. However, differences in SRBs may reflect other underlying differences. For example, SRBs are typically used to increase retention in hard-to-staff fields. The coefficient in our model may reflect the higher turnover that gave rise to the higher SRB levels, rather than the effect of the SRB itself. This relationship holds even when we add fiscal year indicator variables to our regressions, which provides evidence that this result is not being driven by any time-specific trend but by differences across individual service occupations.

Appendix F: Parallel Trends Analysis

As a sensitivity analysis, we explored how our diff-in-diffs estimates change when we vary the size of the pre-policy-change sample. Increasing the size of the pre-policy-change sample provides more observations, but we run the risk of violating the parallel trends assumption. We reestimated our models using data on sailor decisions that predated the policy change by an increasing amount. We then tested whether the parallel trends assumption held by including a variable in the model that denoted the interaction between the female indicator variable and a time trend. If the parameter estimate for the female/time-trend interaction variable is statistically significant at a reasonable confidence level, we will reject the parallel trends assumption. For all cases in which we fail to reject the parallel trends assumption, it is likelier that any difference in the reenlistment rate trends for men and women is due to sampling error or noise than to actual underlying differences in trends.

In Table 8, we show p-values on the coefficient for the female/time-trend interaction variable when including a full set of other control variables. P-values for which there is less than a 10 percent probability of the parallel trends assumption holding are shown in bold. The remaining P-values indicate that there is at least a 50 percent chance that the parallel trends assumption holds.

Table 8. Pre-policy-change sample and the parallel trends assumption

Earliest SEAOS in pre-policy-change sample		Separate controls for women with no children and with any children		Men and women with no children
	Men and all women	With no children	With any children	
Sept. 2010[a]	**0.000**	**0.032**	**0.000**	**0.030**
Sept. 2011[a]	**0.000**	**0.009**	**0.000**	**0.008**
Sept. 2012[a]	**0.003**	0.571	**0.000**	0.585
Sept. 2013[a]	0.609	0.535	**0.022**	0.507

Source: CNA estimates using EMF data on sample of sailors described in Appendix D.
[a] Entries represent p-values on the coefficient for the interaction of female and a time trend (i.e., the probability that any difference in slopes between male and female sailors is due to sampling error and/or statistical noise rather than a true difference in the underlying trends over time). Traditional statistical significance thresholds of 0.10 and 0.05 make it very difficult to reject the null hypothesis that the parallel trends assumption holds. In other words, it is an exceptionally high burden of proof for the parallel trends assumption to fail. Instead, we could have a threshold of 0.5 and not reject the null hypothesis for any additional samples that we display here.

If the sample begins in September 2010 or September 2011, the parallel trends assumption is clearly and unambiguously violated for all four estimates. If the sample begins in September 2012, the parallel trends assumption is violated when comparing all men and all women and when comparing all men and women with children. If the sample begins in September 2013 (as in our analysis), the parallel trends assumption is violated only when comparing men and women with children.

In Table 9, we show how our diff-in-diffs model results vary when we vary the size of the pre-policy-change sample. We present these results even when the parallel trends assumption is violated simply to see how the parameter estimates changed.

Note that estimates of the relationship between the maternity leave policy change and the estimated probability of reenlisting for women without children in column two are all statistically significant and range from 2.2 to 3.6 percentage points, depending on the earliest SEAOS used. However, the parallel trends assumption for this group holds only for the two larger estimates, which use pre-policy-change samples with SEAOSs that occur no earlier than September 2012. For women overall, the parallel trends assumption also holds only for the largest estimate (3.7 percentage points), under a pre-policy-change sample with SEAOSs that occur no earlier than September 2013.

Table 9. Model results with various pre-policy-change samples

Earliest SEAOS in pre-policy-change sample	Men and all women	Separate controls for women with no children and with any children		Men and women with no children
		With no children	With any children	
Sept. 2010	0.0138 (0.0089)	0.0223 ** (0.0099)	-0.0172 (0.0164)	0.0231 ** (0.0099)
Sept. 2011	0.0158 * (0.0091)	0.0221 ** (0.0101)	-0.0087 (0.0168)	0.0231 ** (0.0101)
Sept. 2012	0.0235 ** (0.0096)	0.0303 *** (0.0106)	-0.0025 (0.0177)	0.0312 *** (0.0106)
Sept. 2013	0.0372 *** (0.0104)	0.0360 *** (0.0116)	0.0336 * (0.0192)	0.0366 *** (0.0116)

Source: CNA estimates using EMF data on sample of sailors described in Appendix D.
*** Statistically significant at the 1 percent level.
** Statistically significant at the 5 percent level.
* Statistically significant at the 10 percent level.

Appendix G: Results for 4YO, 5YO and 6YO Sailors

Our main results include only 4YO sailors because their reenlistment decisions are made on a more uniform timeline, typically taking place within one year prior to SEAOS. Sailors with longer initial obligations may choose to reenlist at multiple points during this time; for example, most 6YO sailors choose to reenlist at the hard end of active obligated service (HEAOS) rather than at SEAOS. Therefore, we are left with several suboptimal options for measuring reenlistment decisions: we can use reenlistment windows of different lengths based on initial obligation, or we can use a yearlong decision window ending at HEAOS or SEAOS. In particular, since male sailors are approximately 8 percentage points less likely than female sailors to have a four-year obligation but 8 percentage points more likely to have a six-year obligation, using a longer decision window or reenlistment at SEAOS may make our (male) comparison group systematically different from our (female) treatment group. If we use a uniform decision window for all sailors regardless of initial obligation, basing that window at HEAOS will make it impossible to observe SEAOS loss for 5YO and 6YO sailors, while basing it at SEAOS will make it impossible to observe most reenlistment for these sailors. However, excluding 5YO and 6YO sailors from the analysis altogether omits over half of accessions during the period of our analysis.

To resolve these conflicts, we use a decision window within one year of HEAOS for 5YO and 6YO sailors. We treat all 5YO and 6YO sailors who do not reenlist at HEAOS as SEAOS losses. We know this will underestimate retention rates for this group of sailors. We cannot say for certain, however, whether this will bias our results upward or downward without knowing whether measurement error is correlated with gender and/or parenthood.[28]

Table 10 contains results when we combine the 4YO, 5YO, and 6YO sailors into one sample for our analyses (along with indicator variables for initial service obligation), but otherwise using the same regressions as for our main results. As in the main results, results for sailors with children at their initial SEAOS do not pass the parallel trends requirement when covariates are included (although they do when covariates are omitted). Results for this group should therefore be viewed with caution.

[28] Reference [15] also illustrates that the relationship between reenlistment at HEAOS vice SEAOS for certain 6YO sailors changes over time and depends on several factors, including the SRB level being offered at HEAOS. Again, however, we do not know if changes in the relationship of HEAOS/SEAOS reenlistment propensities are correlated with gender or parenthood.

Table 10. Diff-in-diffs results for 4YO, 5YO, and 6YO sailors

Variable	Women vs. men	Women with no children and with any children vs. men	Women with no children vs. men
Female			
All	-2.1 ppts ***[a, b]	-	-
No children	-	-1.4 ppts *	-1.2 ppts
Any children	-	-4.7 ppts ***	-
Post-policy	-3.5 ppts ***	-3.5 ppts ***	-3.4 ppts ***
Diff-in-diffs			
All	3.0 ppts ***	-	-
No children	-	2.4 ppts ***	2.4 ppts ***
Any children	-	4.7 ppts *	-
Adjusted R^2	0.2287	0.2288	0.2312
N	84,220	84,220	80,031

Source: CNA estimates using EMF data.

[a] The superscripts *, **, and *** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

[b] Results in red are statistically significant and negative, results in green are statistically significant and positive, and results in black are statistically insignificant.

As before, expansion of maternity leave is correlated with higher reenlistment rates for female sailors. Reenlistment rates increase by 3.0 percentage points for female sailors overall, by 2.4 percentage points for female sailors without children as of HEAOS, and by 4.7 percentage points for female sailors with children at HEAOS. There are several potential reasons why the results for women with children are so much larger when 5YO and 6YO sailors are included; for example, sailors' family planning strategies may be correlated with their initial obligation length.

Appendix H: Additional Details on the Impact on Sea Duty Time

Reference [6] contains our estimates of the annual number of women who became pregnant while assigned to sea duty and the amount of sea duty time lost due to early rotation. The authors found that, on average from FY 2004 to FY 2006, about 1,277 first sea tours of paygrade E1–E4 sailors appear to have been interrupted early by pregnancy.[29] The women who appeared to have had disrupted sea tours because of pregnancy served an average of only 21.0 months of sea duty. By comparison, their female counterparts whose sea tours were not disrupted served an average of 37.4 months at sea. Therefore, we assume that first-term 4YO sailors who apparently became pregnant while on sea duty lost an average of 16.4 months (about 67 weeks) of sea duty per sailor.[30]

Next, we used DHA data on births and EMF records to estimate the number of female 4YOs who appeared to have become pregnant while assigned to shore duty and stayed in the Navy long enough to give birth. We estimated that about 680 4YO sailors per year fall into this category. We then estimated the average amount of time these sailors' rotations back to sea were delayed because of pregnancy/operational deferment. On average, we estimate that the scheduled return to sea was delayed by 18 weeks (including those who reached their SEAOS after giving birth, did not reenlist, and therefore did not have any delayed sea duty). Note that we did not count women who became pregnant while on shore duty but did not stay in the Navy long enough to give birth because the likely reason they left was that they reached SEAOS and did not reenlist.

Finally, we estimated the annual amount of additional reenlistment that the longer maternity leave policy produced, the average length of the first reenlistment period, and the average amount of time spent on sea duty in the first reenlistment period. We used our estimate of 3.7 percentage points of additional reenlistment for 4YO women (about 164 women a year), each of whom reenlisted for an average of 43 months (approximately 172 weeks). We also found that, on average, the percentage of time spent on sea duty during women's second reenlistments is about 25 percent.

[29] First-term sailors on sea duty in paygrades E1 through E4 could include 4YO, 5YO, and 6YO sailors. We do not have a breakout by length of obligation (YO), so our estimate likely overstates the number of 4YO sailors who have a disrupted sea tour because of pregnancy.

[30] Some pregnant sailors are moved from sea to shore duty not long before they are scheduled to complete their sea duty and/or SEAOS, thereby losing only a small amount of sea duty time.

To summarize numerically, we find the following:

- Roughly (1,277 sailors x 67 weeks) + (680 sailors x 18 weeks) = 98,102 weeks of sea duty are lost/delayed per year because of pregnancies/births to 4YO female sailors.
- Expansion of maternity leave is associated with an increase of approximately (164 sailors x 172 weeks x 0.25) = 7,052 weeks of sea duty during the first reenlistment period.
- The increased maternity leave reduces the 98,102 weeks of lost/delayed sea duty by 7,052 weeks annually, or about 7 percent.

Note that these calculations are admittedly simplistic, but they provide a rough order of magnitude of the reduction in the amount of sea duty that is lost or delayed due to pregnancy that the longer maternity leave policy may bring about. A comprehensive calculation was beyond the scope of this study.

Figures

Tables

Abbreviations

4YO	four-year obligation
5YO	five-year obligation
6YO	six-year obligation
AC	active component
AFQT	Armed Forces Qualification Test
ASN(FM&C)	Assistant Secretary of the Navy, Financial Management and Comptroller
CO	commanding officer
C-WAY	Career Waypoint
CY	calendar year
DHA	Defense Health Agency
diff-in-diffs	difference-in-differences
DOD	Department of Defense
DON	Department of the Navy
e-leave	electronic leave
EMC	enlisted management community
HEAOS	hard end of active obligated service
HS	high school
LOS	length of service
MS	military spouse
MTF	medical treatment facility
NEC	Navy enlisted classification
OECD	Organization for Economic Cooperation and Development
ppts	percentage points
PRD	projected rotation date
Q1	first quarter
SEAOS	soft end of active obligated service
SH	sexual harassment
SPAWAR	Space and Naval Warfare Systems Command
SRB	selective reenlistment bonus

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