Using Military Deployments and Job Assignments to Estimate the Effect of Parental Absences and Household Relocations on Children's Academic Achievement

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Using Military Deployments and Job Assignments to Estimate the Effect of Parental Absences and Household Relocations on Children's Academic Achievement

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Military deployments and job assignments provide an opportunity to estimate the impact of parental absences and household relocations on children's academic achievement. Combining U.S. Army personnel data with children's standardized test scores from Texas, I find that parental absences adversely affect children's test scores by a tenth of a standard deviation. Likewise, household relocations have modest negative effects on children's test scores. Both parental absences and household relocations have the greatest detrimental effect on test scores of children with single parents, children with mothers in the army, children with lower-ability parents, and younger children.

I. Introduction

More than 950,000 U.S. troops deployed to Afghanistan and Iraq from 2002 through 2004. By the end of 2005, one-third of these soldiers had

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served two overseas tours within a span of 3 years. Lengthy and recurrent deployments coupled with other features of military service, such as frequent household relocations, are apt to place considerable stress on the more than 1.4 million military families.[1] Any associated feelings of anxiety, loneliness, and uncertainty seem especially likely to affect children's achievement in school. As a mother recently remarked about her son, "it affected his grades last year when he knew his father was in Afghanistan—he worries more about daddy dying than just going away and coming back" (Nearin and Segal 2002).

Yet, increasing episodes of parental absences and frequent household relocations are not specific to the military. Recent trends in American family structure suggest that children spend less time with their parents now than they did 30 years ago. For example, according to the Current Population Survey, in 1970, 12% of all children lived with a single parent; by 1996, that number had increased to 28% (U.S. Census Bureau 1996). The number of families with both parents in the work force has also increased sharply. In 1970, only 29% of children under the age of 6 and 39% of children under the age of 18 had both parents in the labor force; by 2000, this number had grown to more than 61% and 68%, respectively (Haveman and Wolfe 1993, 156; Fields and Casper 2001). Work-related travel is another emergent source of parental absences. In 1970, there were roughly 93 million business trips in the United States, or approximately 1.4 annual business trips per household. By 1997, there were more than 213 million U.S. business trips, or about 2.1 annual business trips per household (U.S. Bureau of the Census 2001, table 1255). Finally, Americans move frequently: U.S. Census data show that nearly 17% of American households relocate and 6% relocate to a different county each year (U.S. Bureau of the Census 2001, table 26).

It is not hard to imagine that parental absences and household relocations may diminish a child's sense of security, alter a child's level of responsibility, and/or disrupt a child's social networks. These and other related factors have unpredictable educational consequences for children. For example, a child's academic performance could decline if the child becomes preoccupied with feelings of loneliness. Alternatively, a child's performance could improve if a newfound sense of responsibility accompanies the reduced adult supervision. Similar competing arguments exist for household relocations. A 1994 General Accounting Office study contends that moving disrupts a child's social group and hurts academic performance. Other researchers, like Piaget, have argued that exposing children to different social environments facilitates their understanding of the world and improves

[1] Deployment estimates are from Davey (2004). Military manpower estimates are based on 2002 data from the Directorate for Information Operations and Reports, Office of the Secretary of Defense.

classroom performance (Piaget 1977). Therefore, determining the net effect of these family disruptions requires an empirical analysis.

However, a number of factors complicate a simple cross-family comparison. For example, parents may choose to be absent more or less often or to relocate a household in response to a child's classroom performance. Parental absences and household relocations are also likely to alter household income. As discussed by Haveman and Wolfe (1995), the positive relationship between income and a child's academic performance confounds the predominantly negative parental absence effects found in the literature.[2] Most recent studies focus on absences due to death, divorce, separation, or out-of-wedlock birth but fail to account for the associated lower household income. There is even less consensus on how household relocations affect children's education. Heinlein and Shinn (2000) review this literature and report 26 studies that find no effects, 19 studies that find negative effects, and eight studies that find positive effects. They, too, attribute the mixed findings to inadequate accounting of important factors such as income, since lower income households tend to relocate more frequently.[3]

To reduce the bias that arises from potentially endogenous parental decisions and other unobserved determinants of children's academic achievement, this study exploits exogenous variation in military assignments. Military deployments generate parental absences, and the military's expressed intention to move soldiers every 2–4 years produces frequent household relocations. Using the demands of military service as a source of variation is appealing because soldiers have little control over the frequency and duration of absences and relocations. Media coverage of a recent deployment quoted one soldier as saying, "somebody else other than us [is] deciding where we will live, what missions we will be on, and how long we will be separated [from our families]" (Nearin and Segal 2002). I also provide evidence below suggesting that the military assigns absences and relocations without regard to the academic achievement of military children. Moreover, any effects of parental absences or household relocations are not likely to reflect a change in income because the military is made up of a relatively homogeneous population in terms of socioeconomic status and provides supplemental compensation for deployments and relocations.

Data restrictions and faulty estimation strategies have limited previous attempts to identify the effect of parental absences and household relo-

[2] Haveman and Wolf (1995, 1839); Taubman (1989), McLanahan and Sandefur (1994), and Heinlein and Shinn (2000) demonstrate a positive relationship between income and children's academic achievement.

[3] In 2000, 21% of households with an annual income of less than $25,000 moved, and only 15% of households with an annual income of more than $25,000 moved (Schachter 2001).

cations using military-induced variation. In a study of Gulf War deployments, Pisano (1992) found that sixth-grade girls performed slightly worse in reading when a parent was deployed. However, it is difficult to draw firm conclusions from this study, because it has only 158 observations and the control group is not comparable to the treatment group. A study by Marchant and Medway (1987) found no effect of military-induced household relocations on children's academic outcomes, but their results are based on only 40 observations. The current study improves upon these military-specific studies by using more than 13,000 observations on military children and a rich set of descriptive variables.

The empirical analysis begins with reduced-form estimates of the effect of a parent's deployment on his or her child's math score. Two-stage least squares (2SLS) estimates indicate that the assignment of parental absences is uncorrelated with other potential determinants of children's educational achievement. The design of this experiment is most similar to that in Angrist and Johnson (2000). Angrist and Johnson estimate the effect of Gulf War deployments on divorce rates, spousal employment, and children's disability rates. They find that deployments of male soldiers do not affect the rate of marital dissolution but do reduce spousal employment. In contrast, female deployments increase the rate of marital dissolution but do not affect spousal employment. Angrist and Johnson also find no effect of military deployments on children's disability rates. In part, the current study builds on their research by estimating the effect of military deployments on children's academic achievement.

My estimates indicate that parental absences during the contemporaneous school year have small adverse effects on children's test scores; the magnitude is about a tenth of a standard deviation. Cumulative 4-year absences also have negative effects on children's test scores, with officers' children experiencing a decline of as much as a fifth of a standard deviation. For household relocations, I estimate a modest negative effect on enlisted soldiers' children but no significant effect on officers' children. Other evidence suggests that parental absences and household relocations cause additional detrimental effects to test scores of children with single parents, children with mothers in the army, children with parents having lower AFQT scores, and younger children.

The next section contains background information on the Texas Education Agency (TEA 2000), a description of military assignment mechanisms, and an overview of the data. Section III contains the empirical framework and the identification assumptions. Sections IV and V contain the main results for parental absences and household relocations. Section VI concludes.

II. Background and Data

A. Testing Children in Texas

Texas has conducted standardized testing since 1980, and the state has one of the leading programs in the United States. In 1990, the TEA implemented the Texas Assessment of Academic Skills (TAAS) program. The TAAS exam certifies a student's ability to be graduated from his or her current grade. Schools administer the test in April and May of each year to students in grades 3–8 and grade 10. The TAAS exam evaluates performance in math, reading, science, writing, foreign languages, and social studies at different points throughout a child's progression within the public and charter school systems. Only math scores are used in this study because they are available for all years and all grade levels. Scores in each subject receive a Texas Learning Index (TLI) value from 0 to 100. The TEA normalizes TLI scores to allow comparisons across years for the same student. For example, a student receiving a math score of 75 in the fourth grade and a math score of 80 in the fifth grade has demonstrated individual improvement across grades. Public and charter school students achieving a TLI score of 70 have met the requirements for the respective grade level and are on track to meet the required minimum score of 70 in the tenth grade. Since schools located on military installations belong to local school districts, almost all military children living in Texas take the TAAS exams.

B. Military Assignment Mechanisms

The army's Human Resources Command assigns soldiers to division-level units every 2–4 years based on the "needs of the army." This army-specific term captures the essence of all assignments: world events drive army assignments. While soldiers may indicate a preference for a particular division, the timing of the move and the assignment of a soldier to a subordinate army unit are largely independent of a soldier's preferences. As illustrated in figure 1, once a soldier is assigned to a division, the division assigns the soldier to one of several brigades, the brigade assigns the soldier to one of several battalions, and the battalion assigns the soldier to one of several companies.[4] The "needs of the army" also determine the missions that a soldier's company receives, which ultimately affect how much time a soldier spends away from his or her family. A deployment can occur at the individual or unit level and is characterized by the soldier leaving the base to perform some component of a larger military operation.

[4] For assignment purposes, the army regards soldiers of the same rank and occupation as equals. There are two primary division-level units in Texas, the First Cavalry Division and the Fourth Infantry Division. This study does not include soldiers from specialized units that are likely to deploy more often, such as the special forces or rangers.

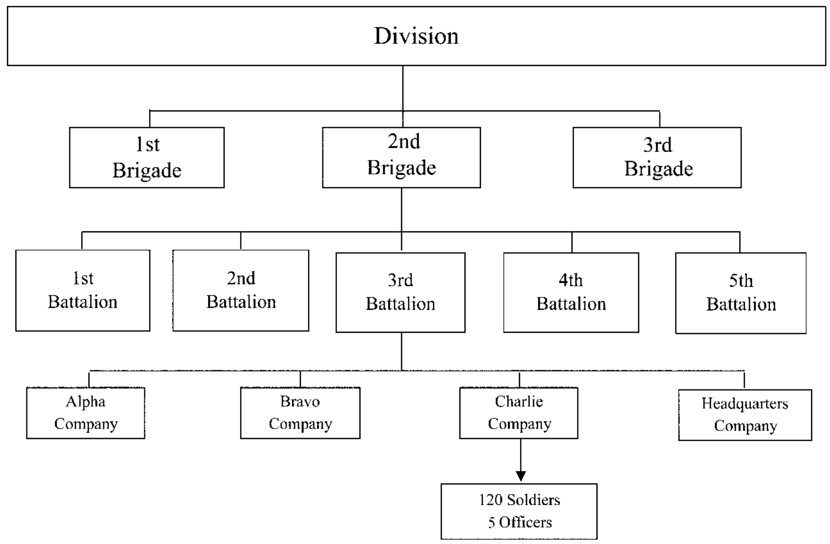

Fig. 1.—Assigning soldiers to units. There were 10 active duty divisions in the army at the time of this study. Division composition varies, but this wire diagram describes the general organization for the two primary divisions stationed in Texas, the First Cavalry Division and the Fourth Infantry Division. For deployment purposes, soldiers in the headquarters company are assigned to one of the three primary maneuver companies: Alpha, Bravo, and Charlie.

During the time frame of this study, units below the brigade level from Texas deployed to support peacekeeping operations in the Balkans, to training and show-of-force maneuvers in the Middle East, and to humanitarian aid missions in developing countries.

C. U.S. Army and Texas Education Agency Data

The military data are from active-duty army personnel records, dependent records, and pay records for fiscal years 1992–98. The sample includes children ages 6–19 who have parents serving in the active-duty army and who were stationed in Texas in 1997 or 1998. Since the army does not maintain reliable records on soldier absences, I use a pay supplement (hostile fire pay) to identify soldier absences.[5] The inherent incentives associated with pay data suggest a relatively accurate assignment of absences; soldiers will seek full compensation for their absences, and the army will ensure that they do not receive too much. I calculate the number of months that a soldier is deployed by dividing the sum of all hostile fire pay received over a designated period of time by the monthly

[5] Soldiers deployed for more than 7 days to designated regions around the world receive hostile fire pay.

hostile fire pay allotment. For the relocation variable, I define the number of moves that a child experiences while his or her parent is in the military as the number of army-induced moves. Other variables include child's gender, child's race, military parent's gender, military parent's marital status, military parent's education level, and military parent's AFQT score. Subsequently, the TEA matched test scores and grade level to the military data for each child.[6] The final data set contains observations for the matched army and TEA data at the level of the individual child.

Table 1 displays descriptive statistics for the parental absence data. Standard errors are in parentheses, and standard deviations are in curly braces. Panel A compares children with an enlisted parent to children with an officer parent. Officers' children score 5–6 points higher on the math section of the TAAS exam and have a smaller standard deviation in test scores than enlisted soldiers' children. Also, all officers have at least some college, and officers do not have an AFQT score. Therefore, I present the results for enlisted soldiers' children and officers' children separately.

Panel B of table 1 compares children with parents who deployed for fewer than 3 months to children with parents who deployed for 3 months or more during the "current" school year. I define the current school year as September 1 of the previous year through March 31 of the current year (1997 or 1998), since schools administer the TAAS exams in April and May. Approximately 6% of children have a parent deployed for more than 3 months during the current school year. I organize panel C identically to panel B but stratify the data by cumulative months deployed over a 4-year period.

Panels B and C show that a child's math score declines as the duration of the parental absence increases. The remaining descriptive variables differ only slightly with varying durations of absences. To explore these correlations more closely, I present estimates from regressions of the parental absence variable on the full set of descriptive variables in the appendix in table A1. Although some of the correlations are statistically significant, their magnitudes are small. Moreover, the set of all 14 descriptive variables explains only 2%–3% of the total variation in parental absences. Nevertheless, there are several military practices that may account for the small correlations found in the data.

One possible explanation for why children in single-military-parent households and children with military mothers experience fewer absences than their counterparts is that single-parent soldiers and female soldiers

[6] The army data met a minimum number of observations for each combination of included variables to comply with the confidentiality requirements of the TEA; data were matched by the child's social security number. Fewer than 1,000 observations were dropped for small cell sizes prior to the match, and there was a 40% match rate between the army and Texas data because 6–19-year-olds were in the army data (14 grades) and the TAAS exam is only given in seven grades.

Table 1
Summary Statistics for Current School Year and Cumulative 4-Year Parental Absences

	A. Parent's Rank		B. Months Parent Deployed in the Current School Year				C. Months Parent Deployed in the Past 4 Years					
			Enlisted Parent		Officer Parent		Enlisted Parent			Officer Parent		
	Enlisted Parent (1)	Officer Parent (2)	0–2 (1)	≥ 3 (2)	0–2 (3)	≥ 3 (4)	0 (1)	1–6 (2)	≥ 7 (3)	0 (4)	1–6 (5)	≥ 7 (6)
TLI math score	77.14	82.47	77.21	75.91	82.56	80.91	77.41	77.17	76.05	82.73	82.38	80.59
	(.11)	(.18)	(.11)	(.50)	(.18)	(.83)	(.13)	(.32)	(.43)	(.20)	(.51)	(.71)
	{12.01}	{9.57}	{11.97}	{12.64}	{9.51}	{10.47}	{11.87}	{12.03}	{12.41}	{9.40}	{9.81}	{10.30}
Male child	.51	.51	.51	.51	.51	.49	.52	.52	.48	.52	.48	.46
	(.00)	(.01)	(.00)	(.02)	(.01)	(.04)	(.01)	(.01)	(.02)	(.01)	(.03)	(.03)
	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}
White child	.44	.79	.44	.47	.79	.75	.43	.50	.40	.78	.81	.76
	(.00)	(.01)	(.00)	(.02)	(.01)	(.03)	(.01)	(.01)	(.02)	(.01)	(.02)	(.03)
	{.50}	{.41}	{.50}	{.50}	{.41}	{.44}	{.50}	{.50}	{.49}	{.41}	{.39}	{.43}
Parents married	.90	.93	.90	.98	.93	.97	.89	.96	.96	.91	.99	.99
	(.00)	(.00)	(.00)	(.01)	(.01)	(.01)	(.00)	(.01)	(.01)	(.01)	(.01)	(.01)
	{.30}	{.26}	{.30}	{.15}	{.26}	{.16}	{.31}	{.19}	{.21}	{.28}	{.12}	{.12}
Father is in the army	.87	.91	.87	.98	.90	1.00	.87	.98	.96	.88	.99	1.00
	(.00)	(.01)	(.00)	(.00)	(.01)	(.00)	(.00)	(.00)	(.01)	(.01)	(.00)	(.00)
	{.33}	{.29}	{.34}	{.12}	{.30}	{.00}	{.33}	{.15}	{.19}	{.32}	{.07}	{.00}

Army parent is a high school graduate	.45		.44	.57			.41	.56	.51			
	(.00)		(.00)	(.02)			(.01)	(.01)	(.02)			
	{.50}		{.50}	{.50}			{.49}	{.50}	{.50}			
Army parent has some college	.55	.14	.56	.43	.13	.28	.58	.44	.49	.13	.16	.19
	(.00)	(.01)	(.00)	(.02)	(.01)	(.04)	(.01)	(.01)	(.02)	(.01)	(.02)	(.03)
	{.50}	{.34}	{.50}	{.50}	{.33}	{.45}	{.49}	{.50}	{.50}	{.34}	{.36}	{.40}
Army parent AFQT (top 40%)	.27		.28	.25			.28	.26	.21			
	(.00)		(.00)	(.02)			(.00)	(.01)	(.01)			
	{.45}		{.45}	{.43}			{.45}	{.44}	{.41}			
Elementary-age child (grades 3–6)	.64	.60	.64	.68	.61	.59	.63	.66	.66	.62	.56	.58
	(.00)	(.01)	(.00)	(.02)	(.01)	(.04)	(.01)	(.01)	(.02)	(.01)	(.03)	(.03)
	{.48}	{.49}	{.48}	{.47}	{.49}	{.49}	{.48}	{.47}	{.48}	{.49}	{.50}	{.49}
Observations	11,548	2,900	10,904	644	2,742	158	8,841	1,373	818	2,294	366	213

Source.—The army data are from the Office of Economic Manpower Analysis (West Point, NY).

Note.—Standard errors are in parentheses, and standard deviations are in curly braces. Data in panel A correspond to the data used in panel B but not to the data used in panel C. The data-matching process does not guarantee the same observations in both the current academic year and the 4-year data sets, although the statistics presented in panel A using the data in panel C are comparable. There are only 11,311 observations for AFQT in panels A and B and 10,891 observations for AFQT in panel C. The army data cover children ages 6–19 with a social security number and parents in the active duty army stationed in Texas in 1997 or 1998. Dual military families are dropped. Absence variables are constructed using army pay data over the current academic school year for panels A and B and over the past 51 months for panel C. The current academic school year is defined as September 1 of the previous year through March 31 of the current year. Deployments correspond to a soldier receiving hostile fire pay. The number of months absent is determined by dividing the sum of hostile fire pay over the period by the monthly hostile fire pay allowance. Children's math scores (range 0–100) are from the Texas Education Agency (TEA) testing years 1997 and 1998 in grades 3–8 and 10. Under advisement of the TEA, scores below 35 are dropped to account for children who did not take the exam seriously or who quit in the middle of it (this accounts for .5% of the sample and does not affect the results). Army officers must have at least some college, and they do not take the AFQT. This study separates AFQT quintiles into two groups: top 40% and bottom 60%.

may return from their mission prematurely to address family problems.[7] Returning early from a deployment could shorten the deployment length enough to classify the absence as fewer than 3 months. The practice of deployed units leaving a small detachment of soldiers at the home station to care for families and process administrative actions may explain why soldiers with more education are deployed less often than soldiers with less education. Unexpected deployments often cause soldiers to lose tuition money for college courses that they take during off-duty hours. These soldiers would be likely candidates for stay-back personnel. Although uncommon, these cases could account for the small correlations in table A1. I examine this issue further in the next section and conduct several robustness checks for the main results.

III. Empirical Framework

The identification strategy for this study relies on the assumption that military-induced absences and relocation assignments provide a plausible source of exogenous variation. The nature of military assignment mechanisms suggests that these episodes come closer to providing a causal interpretation of the effect of parental absences and household relocations on children's academic achievement than other comparisons. To investigate this hypothesis more formally, I employ a basic linear model, using pooled data from 1997 and 1998, with the following structure:

$$E_{it} = \alpha + \theta_{1998} + \delta D_{it} + \beta X_{it} + \varepsilon_{it}. \quad (1)$$

Here the left-hand-side variable E_{it} is the TLI test score on the math section, α is a constant, and θ_{1998} is a year dummy for 1998. The coefficient δ on the dichotomous variable of interest D_{it} represents the effect of parental absences (or household relocations) on the TLI math score of child i in time period t (1997 or 1998). The symbol X_{it} denotes other covariates, including the child's gender, race, and grade level, as well as the marital status of the military parent, gender of the military parent, civilian education level of the military parent, and AFQT score of the military parent. Since some children appear in the data in both years, I cluster all standard errors on the individual child using Huber-White robust standard errors.

A causal interpretation of δ requires D_{it} to be free of measurement error and orthogonal to other potential determinants of children's academic achievement as represented by ε_{it}. Measurement error concerns are minimal because both the army and the individual soldiers review and update personnel records monthly. Likewise, the nature of military assignment mechanisms suggests that the army does not deploy or relocate soldiers

[7] Angrist and Johnson (2000) find that female deployments increase the rate of marital dissolution.

with their children's academic achievement in mind. However, it is possible that the army deploys or relocates some soldiers for reasons that are correlated with their child's academic achievement, as explained above.

One way to address this concern is to include characteristics in X_{it} that are observable to the army (from its own data) and that could potentially be correlated with children's educational achievement. If all relevant controls are included and the assignment procedures discussed in Section II.B hold, then the estimated treatment effect is even more likely to have a causal interpretation. However, the most compelling way to test the exogenous assignment hypothesis is with a valid instrumental variable. For parental absences, a valid instrument is one that would be correlated with individual parental absences and uncorrelated with other potential determinants of children's educational achievement.

I construct an instrumental variable for parental absences using the soldier's unit of assignment at the battalion level (see fig. 1). Since deployments can occur at the level of the individual or the unit, I create the instrumental variable by assigning a one to all those in a battalion that had more than one-third of its soldiers deploy and a zero otherwise. One-third of a unit is a logical choice because most battalions consist of three main companies.[8] Units deploy as part of a task force, a heterogeneous mix of companies from different battalions. The selection of which companies will constitute a deploying task force seems likely to be uncorrelated with individual-level children's educational achievement. There should also be a positive correlation between the deployment of a battalion and the deployment of an individual soldier; a soldier is more likely to deploy if his or her battalion must deploy one or more of its companies than if his or her battalion does not receive such an order.

Correlations between the instrumental variable and the characteristic variables are presented in panel D of table A1. As in panel A of this table, some of the variables have statistically significant correlations, but they are small and explain only 2%–4% of the total variation in the instrumental variable. Most of the variation in the instrumental variable comes from division-level and brigade-level decisions as to which exact battalions receive a deployment order. It is unlikely that divisions and brigades select a battalion to deploy based on unobserved characteristics that are related to the academic achievement of the children whose parents are assigned to that unit. Therefore, instrumental variable estimates that control for the individual-level observable characteristics available to divisions and brigades seem especially likely to provide a useful test of the assumption that deployment assignments are exogenous.

[8] The three primary companies are Alpha, Bravo, and Charlie. The headquarters company is divided among the three primary companies to provide maintenance and logistical support for deployments.

IV. Empirical Results for Parental Absences

In table 2, I present ordinary least squares (OLS) and two-stage least squares (2SLS) estimates of the impact of parental absences of 3 months or more during the current school year on children's math scores. Panel A contains estimates for the children of enlisted soldiers, and panel B contains estimates for the children of officers. Columns 1 and 2 are the most parsimonious specifications, containing only a constant, a dummy variable for the year 1998, dummy variables for grades 4–8 and grade 10, and the absence variable. However, as discussed above, a causal interpretation is more likely after conditioning on observable characteristics that are also possibly correlated with children's academic achievement. Therefore, specifications in columns 3 and 4 contain child characteristics, while those in columns 5 and 6 contain both child and parental characteristics. Including child and parental controls alters δ only slightly. Since estimates of δ remain relatively stable with the inclusion of relevant control variables, the effect of other less relevant variables that are possibly omitted is also likely to be quite small.[9]

Before discussing estimates of δ further, it is informative to highlight briefly the coefficients on the child and parental variables contained in X_{it}. These estimates suggest that boys score slightly lower than girls for enlisted soldiers' children but not for officers' children; whites score higher than nonwhites; children with a male parent in the army score higher than children with a female parent in the army; children with less educated parents score lower than children with more educated parents; and children with high-ability parents, as measured by the AFQT, score higher than children with low-ability parents.

The OLS estimates of δ indicate that children whose parents are absent for 3 months or more score approximately one point lower than children whose parents are absent fewer than 3 months during the current academic school year. The size of the effect is equivalent to a tenth of a standard deviation decline in the test scores of enlisted soldiers' children. I use the 2SLS estimates in columns 2, 4, and 6 to test the hypothesis that military-induced parental absences are exogenous, or rather that the orthogonality assumption for OLS holds for the specification in equation (1). The first-stage results for the 2SLS specifications are shown at the bottom of the respective columns. They are statistically significant and have the anticipated sign. Additionally, the instrumental variable explains approximately 60% of the variation in individual absences. Comparisons of the OLS and 2SLS point estimates reveal only small differences, and a Hausman specification

[9] Altonji, Elder, and Taber (2000) show that this is a reasonable informal test that indicates the degree to which small correlations between the variable of interest and other unobservable characteristics may bias estimates.

Table 2
OLS and 2SLS Estimates for Current School Year Parental Absences

	A. Enlisted Parent						B. Officer Parent					
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)
Absent ≥ 3 months	−.914	−.839	−1.027	−.993	−1.133	−1.196	−1.573	−2.192	−1.413	−1.739	−1.231	−1.497
	(.511)	(.650)	(.506)	(.644)	.506)	(.643)	(.823)	(1.082)	(.839)	(1.106)	(.820)	(1.081)
Male child			−.795	−.795	−.766	−.766			−.209	−.210	−.228	−.229
			(.284)	(.284)	(.286)	(.286)			(.466)	(.466)	(.459)	(.459)
White child			3.536	3.536	2.687	2.687			3.667	3.662	3.437	3.434
			(.281)	(.281)	(.303)	(.303)			(.596)	(.596)	(.597)	(.597)
Parents married					.254	.255					−.012	−.011
					(.475)	(.475)					(.758)	(.758)
Father is in the army					2.299	2.302					1.255	1.268
					(.480)	(.481)					(.747)	(.748)
Army parent is a high school graduate					−.952	−.950						
					(.294)	(.294)						
Army parent has some college											−2.005	−1.989
											(.639)	(.636)
Army parent AFQT (top 40%)					2.213	2.213						
					(.321)	(.321)						
First stage		.748		.748		.746		.866		.867		.863
		(.016)		(.016)		(.016)		(.029)		(.029)		(.029)
Partial first-stage R^2		.60		.59		.59		.61		.61		.59
Observations	11,548	11,548	11,548	11,548	11,311	11,311	2,900	2,900	2,900	2,900	2,900	2,900

Note.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998 and grades 4–8 and 10. Other controls added as indicated. Differences in sample sizes within a panel are a result of some enlisted soldiers missing AFQT scores. The instrument used in the 2SLS estimates is constructed from the unit of assignment. The unit is considered "deployed" when at least one-third of the unit is deployed during the academic school year. Hausman test statistics have the following p-values: panel A—cols. 1 and 2 = .84, cols. 3 and 4 = .99, and cols. 5 and 6 = .86; panel B—cols. 1 and 2 = .32, cols. 3 and 4 = .60, and cols. 5 and 6 = .67. See note in table 1 for additional sample description.

test fails to reject the null hypothesis that the orthogonality condition holds for all OLS specifications in table 2.[10]

In table 3, I provide an additional robustness test to determine if children with single military parents, children with mothers in the army, and children with less educated parents affect the OLS estimates of δ. For comparison purposes, column 1 in each panel contains the estimates from column 5 in the corresponding panels of table 2. Samples in column 2 do not include children with a single military parent or children with a mother in the army. In column 3, I restrict the sample to only children with a parent who has some college. In column 4, I restrict the sample to children with married parents, a father in the military, and a military parent with some college. Point estimates of δ from the restricted samples in columns 2, 3, and 4 are similar to point estimates from the full sample in column 1. Therefore, the small correlations of absences with marital status, gender of the military parent, and education level of the military parent do not appear to be driving the estimates of δ in the full sample.

Based on the results from these robustness tests in table 3, combined with the specification tests in table 2 and the description of the military's assignment mechanism in Section II.B, there is strong evidence to support my claim that military deployments offer a plausible source of exogenous variation.[11] Accordingly, I proceed with the remainder of the analysis on parental absences using OLS to estimate the model in equation (1).

Table 4 is similar to table 2 except that the variable of interest is cumulative 4-year parental absences. This approach tests for the presence of aggregate or long-term effects of parental absences. I stratify the cumulative parental absences by three categories: 0 months, 1–6 months, and 7 months or more over the previous 4 years. Using the model in equation (1), I include dummy variables in D_{it} for children with a parent absent 1–6 months and for children with a parent absent 7 months or more, making children with a parent not absent over the past 4 years the omitted category.

As in table 2, estimates of δ are only slightly sensitive to the inclusion of additional control variables. The specification in column 3 contains the full set of observable characteristics. Estimates in column 3 of panel A

[10] See the table 2 note for the Hausman test p-values. All are insignificant at the 95% confidence level.

[11] As an additional falsification exercise, I test how parental absences in 1998 affect academic achievement in 1997. I find that parental absences in 1998 have no measurable effect on academic achievement scores in 1997 (0.187 points with a standard error of 1.30). By way of comparison, parental absences in 1998 adversely affect 1998 achievement scores by 1.26 points (standard error of 1.25). While small sample size mitigates the conclusiveness of this exercise, the point estimates suggest that the effect of absences is contemporaneous and not present across years.

Table 3
Robustness Test: OLS Estimates for Current School Year Parental Absences

	A. Enlisted Parent				B. Officer Parent			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Absent ≥ 3 months	−1.133	−1.082	−1.317	−1.302	−1.231	−1.173	−1.158	−1.148
	(.506)	(.512)	(.765)	(.759)	(.834)	(.854)	(.932)	(.961)
Male child	−.766	−.620	−.640	−.534	−.228	−.169	−.393	−.381
	(.286)	(.312)	(.380)	(.420)	(.459)	(.495)	(.497)	(.542)
White child	2.687	2.551	2.493	2.287	3.437	3.440	3.708	3.831
	(.303)	(.329)	(.410)	(.452)	(.597)	(.667)	(.658)	(.755)
Parents married	.254		.550		−.012		.385	
	(.475)		(.611)		(.758)		(.793)	
Father is in the army	2.299		2.212		1.255		1.035	
	(.480)		(.613)		(.747)		(.748)	
Army parent is a high school graduate	−.952	−.949						
	(.294)	(.319)						
Army parent has some college					−2.005	−2.093		
					(.639)	(.647)		
Army parent AFQT (top 40%)	2.213	2.342	2.668	3.037				
	(.321)	(.352)	(.421)	(.467)				
R^2	.05	.05	.06	.06	.05	.05	.05	.04
Observations	11,311	9,488	6,252	5,103	2,900	2,552	2,503	2,164
Sample restricted to children with married/fathers in the army	No	Yes	No	Yes	No	Yes	No	Yes
Sample restricted to children whose parents have some college (enlisted) or have a college degree (officer)	No	No	Yes	Yes	No	No	Yes	Yes

Note.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998 and grades 4–8 and 10. Other controls added as indicated. See note in table 1 for additional sample description.

Table 4
OLS Estimates for Cumulative 4-Year Parental Absences

	A. Enlisted Parent			B. Officer Parent		
	(1)	(2)	(3)	(1)	(2)	(3)
Absent 1–6 months	−.401	−.632	−.633	−.289	−.388	−.482
	(.381)	(.376)	(.377)	(.585)	(.578)	(.580)
Absent ≥ 7 months	−1.602	−1.517	−1.514	−2.149	−2.079	−2.127
	(.515)	(.506)	(.504)	(.819)	(.815)	(.819)
Male child		−.796	−.748		−.159	−.181
		(.289)	(.289)		(.468)	(.462)
White child		3.568	2.798		3.574	3.351
		(.286)	(.307)		(.592)	(.596)
Parents married			.566			.057
			(.496)			(.770)
Father is in the army			1.625			1.249
			(.513)			(.750)
Army parent is a high school graduate			−.778			
			(.299)			
Army parent has some college						−1.740
						(.641)
Army parent AFQT (top 40%)			2.103			
			(.325)			
Observations	11,032	11,032	10,891	2,873	2,873	2,873
R^2	.02	.05	.05	.02	.05	.05

NOTE.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998 and grades 4-8 and 10. Other controls added as indicated. Differences in sample sizes within a panel are a result of some enlisted soldiers missing AFQT scores. Parental months absent are the number of months absent out of the past 51 months. See note in table 1 for additional sample description.

reveal a marginally significant decline in math scores of 0.63 points for children with a parent deployed between 1–6 months during the last 4 years relative to children with no parental deployments. There is also a significant decline of 1.5 points for children with a parent deployed 7 or more months during the previous 4 years relative to children with no parental deployments. Panel B contains the estimates for officers' children. Like the enlisted estimates, the effect for children with parents absent 1–6 months over the past 4 years remains small and insignificant, but children with parents absent 7 months or more experience a decline of 2 points in test scores (a fifth of a standard deviation).

A comparison of the 1.13 point decline associated with parental absences of 3 months or more in the current school year (table 2) with the 0.63 point decline associated with parental absences of 1–6 months in duration over the past 4 years (table 4) suggests that the detrimental effect of a parental absence may lessen over time. Furthermore, the larger 1.51 point decline associated with a longer parental absence over the past 4 years as compared to estimates of shorter parental absences suggests that absences of longer duration have larger adverse effects on children's test scores.

Since certain characteristics of children and their parents can exacerbate these effects, I include interaction specifications for children of enlisted soldiers in table 5.[12] Panel A compares absence estimates for children with a father in the army relative to children with a mother in the army. For all of my measures of parental absences, the absence of a mother has an adverse effect that is at least as strong as the absence of a father, and in most cases, the effect is a much stronger one. Since only 13% of the children in this sample have a mother in the army, the standard errors on these estimates are relatively large. Only the estimate for children with a mother who is deployed for 7 months or more over the last 4 years is statistically significant. Estimates in column 3 indicate that children with a father in the army who is deployed for 7 months or more during the past 4 years experience a 1.36 point decline in test scores relative to children with no parental deployments over the past 4 years. In contrast, children with a mother in the army who is deployed for 7 months or more experience a 5.07 point decline in test scores relative to children with no parental deployments over the past 4 years.

Panel B of table 5 contains similar specifications that compare children with married parents to children with a single parent. Single parents make up only 10% of the sample, so again the standard errors are large. However, point estimates have a pattern similar to those in panel A. Children with an absent single parent score worse than children with an absent married parent.

Comparisons for children with parents in the top 40% and the bottom 60% of the AFQT distribution are in panel C. In all cases, there is no statistically significant decline in academic achievement for children with parents in the top 40% of the AFQT distribution who experience a parental absence. Yet, there is a significant negative effect for children with parents in the bottom 60% of the AFQT distribution. This finding further supports the army's use of the AFQT score as a measure of potential success in the armed forces: the households of soldiers who have higher AFQT scores are better able to handle the parental absences associated with a military vocation.

Finally, panel D contains evidence that parental absences have larger adverse effects on younger children than older children. Jensen, Martin, and Watanabe (1996) find similar results for behavioral responses of young children with parents deployed during the Gulf War. Weisenberg et al.

[12] I do not present results for officers' children because officers do not have AFQT scores and the sample is too small to produce informative estimates.

Table 5
OLS Interacted Current School Year and Cumulative 4-Year Parental Absence Specifications for Children of Enlisted Soldiers

	Deployed ≥3 Months in the Current School Year (1)	Deployed 1–6 Months in the Past 4 Years (2)	Deployed ≥7 Months in the Past 4 Years (3)
A. Father in the army versus mother in the army:			
Father is in the army	−1.111	−.594	−1.357
	(.507)	(.384)	(.512)
Mother is in the army	−2.478	−1.570	−5.073
	(5.167)	(1.805)	(2.593)
B. Married parent versus single parent:			
Parent is married	−1.026	−.573	−1.489
	(.511)	(.385)	(.517)
Parent is single	−5.513	−2.075	−1.957
	(3.237)	(1.715)	(2.185)
C. Army parent has high AFQT versus army parent has low AFQT:			
Parent in top 40% of AFQT	−.016	−.286	−.925
	(.959)	(.698)	(.938)
Parent in bottom 60% of AFQT	−1.503	−.754	−1.679
	(.589)	(.444)	(.587)
D. Elementary-level versus secondary-level children:			
Elementary-age child (grades 3–6)	−1.444	−.654	−1.858
	(.621)	(.453)	(.639)
Secondary-age child (grades 7, 8, and 10)	−.478	−.599	−.866
	(.862)	(.621)	(.770)
Observations	11,311	10,891	10,891

Note.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998, grades 4–8 and 10, child's gender, child's race, parent's marital status, military parent's gender, military parent's education level, and military parent's AFQT quartile. There are no officer results presented because officers do not have AFQT scores and the sample is too small to produce informative estimates. See note in table 1 for additional sample description.

(1993) also observe a larger adverse effect among younger Israeli children during the Gulf War.

V. Empirical Results for Relocations

In this section, I estimate the impact of household relocations on children's academic achievement. I use an approach parallel to that in the previous section, but here D_{it} from equation (1) represents the number of moves a child has made since the parent has been in the military. Table 6 contains summary statistics presented by rank of the parent in panel A and by number of military-induced moves in panel B. Similar to the parental absence section, comparisons across the relocation categories reveal small correlations with a few of the relevant descriptive variables. Unfortunately, in this case I do not have an instrumental variable to test the assumption that relocation assignments are exogenous. However, the small degree of correlation between the relocation variables and the other observable variables shown in appendix table A2 supports the assertion that the "needs of the army" and not the personal characteristics of soldiers determine relocations.[13] Interpreting causal estimates of δ from the model in equation (1) requires that military-induced relocations be orthogonal to other potential determinants of children's academic achievement.[14] As in the parental absence section, various robustness tests support this assumption.

Table 7 contains the main estimates for relocation effects. Estimates for enlisted soldiers' children are in panel A, while estimates for officers' children are in panel B. Dummy variables for children who experience three or four moves and children who experience five or more moves make up D_{it}, so the omitted category is children who experience fewer than three moves. Consistent with the identification assumption, estimates of δ in columns 1–3 are only modestly sensitive to the inclusion of additional control variables. Moreover, dropping children with a single parent, a mother in the army, a parent with a low AFQT score, or a parent

[13] The observable variables in table A2 explain less than 3% of the overall variation in relocations for the 3–4 moves category. The grade level of the child explains most of the 11% variation in relocations for the 5-or-more moves category because older children are more likely to have moved more times.

[14] I draw additional support for the exogenous relocation assignment claim from Angrist and Johnson (2000, 43). They assert, "The nature of duty assignments varies considerably, and families have little control over the timing of moves or the location of the next job." While soldiers may submit a preference for a duty location, in this study it is the number of relocations that serves as the source of variation. As long as the frequency of moves is uncorrelated with duty location preferences and the previous assignment locations, the identifying assumption holds.

Table 6
Summary Statistics for Household Relocations

	A. Parent's Rank		B. Number of Moves					
			Enlisted Parent			Officer Parent		
	Enlisted Parent (1)	Officer Parent (2)	0–2 (1)	3–4 (2)	≥ 5 (3)	0–2 (4)	3–4 (5)	≥ 5 (6)
TLI math score	77.20	82.56	78.19	77.45	76.20	83.25	82.60	82.25
	(.12)	(.19)	(.26)	(.17)	(.22)	(.47)	(.30)	(.29)
	{11.95}	{9.60}	{11.36}	{11.87}	{12.35}	{9.33}	{9.86}	{9.41}
Male child	.52	.52	.48	.52	.52	.51	.50	.54
	(.00)	(.01)	(.01)	(.01)	(.01)	(.03)	(.02)	(.02)
	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}	{.50}
White child	.43	.82	.45	.44	.41	.87	.80	.81
	(.00)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.01)
	{.49}	{.39}	{.50}	{.50}	{.49}	{.34}	{.40}	{.39}
Parents married	.93	.97	.92	.93	.94	.93	.96	.98
	(.00)	(.00)	(.01)	(.00)	(.00)	(.01)	(.01)	(.00)
	{.25}	{.18}	{.28}	{.25}	{.23}	{.26}	{.19}	{.12}

Father is in the army	.92	.95	.84	.92	.95	.85	.96	.98
	(.00)	(.00)	(.01)	(.00)	(.00)	(.02)	(.01)	(.00)
	{.28}	{.21}	{.37}	{.27}	{.22}	{.36}	{.19}	{.13}
Army parent is a high school graduate	.45		.56	.44	.40			
	(.00)		(.01)	(.01)	(.01)			
	{.50}		{.50}	{.50}	{.49}			
Army parent has some college	.55	.12	.44	.56	.60	.05	.12	.13
	(.00)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)	(.01)
	{.50}	{.32}	{.50}	{.50}	{.49}	{.22}	{.33}	{.34}
Army parent AFQT (top 40%)	.25		.26	.27	.22			
	(.00)		(.01)	(.01)	(.01)			
	{.43}		{.44}	{.44}	{.41}			
Elementary-age child (grades 3–6)	.64	.60	.87	.67	.45	.75	.67	.48
	(.00)	(.01)	(.01)	(.01)	(.01)	(.02)	(.01)	(.02)
	{.48}	{.49}	{.33}	{.47}	{.50}	{.43}	{.47}	{.50}
Observations	10,206	2,502	1,965	5,023	3,218	389	1,093	1,020

Source.—The army data are from the Office of Economic Manpower Analysis (West Point, NY).

Note.—Standard errors are in parentheses, and standard deviations are in curly braces. There are only 10,121 observations for AFQT. The army data cover children ages 6–19 with a social security number and parents in the active duty army stationed in Texas in 1997 or 1998. Dual military families are dropped. The number of moves equals the number of moves that a child makes since the parent has been in the army. Children's math scores (range 0–100) are from the Texas Education Agency (TEA) testing years 1997 and 1998 in grades 3–8 and 10. Under advisement of the TEA, scores below 35 are dropped to account for children who did not take the exam seriously or quit in the middle of it (this accounts for .5% of the sample and does not affect the results). Army officers must have at least some college, and they do not take the AFQT. This study separates AFQT quintiles into two groups: top 40% and bottom 60%.

Table 7
OLS Estimates for the Number of Household Relocations

	A. Enlisted Parent					B. Officer Parent				
	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
3–4 moves	−.376	−.334	−.703	−.977	−1.391	−.344	−.083	−.194	−.395	−.145
	(.354)	(.352)	(.354)	(.382)	(.514)	(.613)	(.613)	(.617)	(.651)	(.676)
≥ 5 moves	−1.237	−1.081	−1.487	−1.576	−1.854	−.210	.033	−.104	−.195	−.140
	(.416)	(.411)	(.416)	(.442)	(.591)	(.638)	(.637)	(.654)	(.670)	(.697)
Male child		−.759	−.730	−.647	−.470		−.481	−.491	−.447	−.577
		(.300)	(.300)	(.318)	(.424)		(.508)	(.500)	(.518)	(.558)
White child		3.469	2.533	2.515	2.210		3.763	3.648	3.635	3.925
		(.297)	(.323)	(.334)	(.458)		(.700)	(.699)	(.720)	(.801)
Parents married			.810					−.064		
			(.604)					(1.259)		
Father is in the army			2.410					2.210		
			(.604)					(1.065)		
Army parent is a high school graduate			−1.011	−.978						
			(.308)	(.325)						
Army parent has some college								−2.007	−1.969	
								(.718)	(.718)	
Army parent AFQT (top 40%)			2.201	2.356	3.041					
			(.346)	(.360)	(.472)					
R^2	.02	.04	.05	.05	.06	.02	.04	.05	.05	.04
Observations	10,206	10,206	10,121	9,038	4,887	2,502	2,502	2,502	2,355	2,066
Sample restricted to children with married/fathers in the army	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Sample restricted to children whose parents have some college (enlisted) or have a college degree (officer)	No	No	No	No	Yes	No	No	No	No	Yes

Note.—Dependent variable is Texas Learning Index scores for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998 and grades 4–8 and 10. Other controls added as indicated. Differences in sample sizes within a panel are a result of some enlisted soldiers missing AFQT scores and dropping children with single parents, mothers in the army, and low education levels where indicated. For panel A, omitting children whose parents had low AFQT scores does not affect the results. See note in table 6 for additional sample description.

with only a high school degree has little effect on the point estimates in columns 4 and 5.

The specification in column 3 of panel A contains the full set of relevant control variables for the entire sample of enlisted soldiers' children. Estimates of δ indicate that children who move three or four times score 0.7 points lower than children who move fewer than three times. Children who move five or more times score 1.5 points lower than children who move fewer than three times. For children of enlisted soldiers, these estimates imply that the number of relocations has an increasingly adverse effect on academic achievement. In contrast, parallel estimates for officers in panel B are close to zero and insignificant. While a detailed analysis of differences between the children of enlisted soldiers and those of officers is beyond the scope of this article, these findings suggest that some dimension of an officer's family, perhaps greater parental education or higher income, mitigates the adverse effects of relocations.

There is, however, a potentially confounding issue with regard to measuring relocation effects on standardized test scores. A common observation on standardized tests is that students become more proficient at taking the exams over time. The construction of the relocation variable allows for the possibility that children who have moved fewer times could also have spent more time in Texas. Thus, the estimates may be picking up a time-in-Texas effect rather than a relocation effect. For about 60% of the sample, I am able to establish the number of concurrent years that a child has taken the TAAS exams. Therefore, in table 8, I include control variables for time in Texas to determine if they affect the main estimates found in table 7.

For comparison purposes, column 1 of table 8 contains estimates from the specification in column 3 of table 7. In column 2, the sample contains only children for whom I can ascertain the number of TAAS exams taken. Comparisons of columns 1 and 2 in panel A reveal that the point estimate for three or four moves is about half the size of the estimate in column 1, while the point estimate for the five or more moves category changes only slightly. Estimates in column 3 indicate a strong time-in-Texas effect. A child who takes the TAAS exam a second time scores 3.12 points higher than the first time he or she took the TAAS exam. By the third time a child takes the TAAS exam, he or she scores 5.17 points higher than the first time. I include estimates from specifications containing both the relocation variables and the time-in-Texas controls in column 4. Comparing estimates in column 4 to those in columns 2 and 3 reveals no significant correlations between the number of moves and the time in Texas.

Although the results for time in Texas are empirically striking, they are difficult to interpret. One possible interpretation is that these estimates are picking up an effect of children becoming more familiar with the

Table 8
OLS Estimates for Household Relocations and Time in Texas

	A. Enlisted Parent				B. Officer Parent			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
3–4 moves	−.703	−.481		−.495	−.194	.039		.115
	(.354)	(.431)		(.428)	(.617)	(.730)		(.729)
≥ 5 moves	−1.487	−1.268		−1.036	−.104	−.150		−.068
	(.416)	(.522)		(.521)	(.654)	(.790)		(.786)
Child is taking TAAS exam for the second time			3.116	3.064			1.715	1.715
			(.411)	(.412)			(.563)	(.565)
Child is taking TAAS exam for the third time			5.171	5.121			.599	.569
			(.562)	(.563)			(1.049)	(1.043)
R^2	.05	.05	.07	.07	.05	.05	.06	.06
Observations	10,121	6,462	6,462	6,462	2,502	1,675	1,675	1,675

Note.—Dependent variable is Texas Learning Index scores for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998, grades 4–8 and 10, child's gender, child's race, parent's marital status, military parent's gender, military parent's education level, and military parent's AFQT quintile (enlisted only). The data used in table 7 were merged by cells with a panel data set created specifically for this test. Cells consist of year, grades, child's gender, child's race, parent's marital status, military parent's gender, military parent's education level, and military parent's AFQT quintile (enlisted only), relocation status, and math score. Identical cells were dropped (630) from the premerged test data. Since only data from 1997 and 1998 are used, a child can take the TAAS exam at most three times. Differences in sample size between col. 1 and cols. 2–4 are a result of matching with the duration data. All observations with a score prior to 1996 or that have an initial score in tenth grade are dropped, since the length of time in Texas cannot otherwise be determined. See note in table 6 for additional sample description.

TAAS exams over time. An alternative explanation is that prior locations may have had lower educational standards than Texas schools; in that case, these estimates reflect a pure increase in human capital development or a catching-up effect. It is also possible that children who live in Texas for a longer duration may perform better on the test because of increased stability from remaining in one location longer. Untangling this issue is not possible with the data used in this study; however, the results raise important questions for future research.

Finally, table 9 contains estimates from interacted specifications (as in table 5) to determine how household relocation effects vary across different households. The interpretation of these findings is consistent with that discussed in the parental absence section. Estimates in panel A show that children with a father in the army who move five or more times score 1.5 points lower than children who move fewer than three times. However, children with a mother in the army who move five or more times score 2.6 points lower than children who move fewer than three times. Likewise, among children who move five or more times, estimates in panel B reveal a 0.83 point difference in test scores between children

Table 9
OLS Interacted Household Relocation Specifications

	Moved 3–4 Times (1)	Moved ≥ 5 Times (2)
A. Father in the army versus mother in the army:		
Father is in the army	−.854	−1.476
	(.374)	(.432)
Mother is in the army	.675	−2.600
	(1.029)	(1.439)
B. Married parent versus single parent:		
Parent is married	−.770	−1.450
	(.369)	(.427)
Parent is single	.130	−2.282
	(1.174)	(1.434)
C. Army parent has high AFQT versus low AFQT:		
Parent in top 40% of AFQT	−.698	−.121
	(.606)	(.698)
Parent in bottom 60% of AFQT	−.698	−1.891
	(.422)	(.481)
D. Elementary-level versus secondary-level children:		
Elementary-age child (grades 3–6)	−.636	−1.979
	(.379)	(.486)
Secondary-age child (grades 7, 8, and 10)	−.530	−.694
	(.920)	(.927)
Observations	10,121	10,121

NOTE.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998, grades 4–8 and 10, child's gender, child's race, parent's marital status, military parent's gender, military parent's education level, and military parent's AFQT quartile. There are no officer results presented because officers do not have AFQT scores and the sample is too small to produce informative estimates. See note in table 6 for additional sample description.

with single parents and children with married parents. In panel C, children with parents in the top 40% on the AFQT experience no significant effect from an increased number of moves. Meanwhile, children with parents in the bottom 60% on the AFQT score nearly two points lower when they move five or more times relative to children who move less than three times. Also, panel D shows that younger children score worse than older children who move five or more times.[15]

VI. Interpretation and Conclusion

Although using the military to evaluate the effect of parental absences and household relocations on children's academic achievement is appealing from an empirical perspective, the unique nature of military service also requires a careful interpretation of the findings. For example, lessons from this study may not generalize because of differences between the underlying military and civilian populations. At the time of this study, the military was manned with an all-volunteer force and only accepted applicants who met minimum mental, physical, and medical standards. Episodes of parental absences and household relocations in the military may also differ from those in the civilian sector in terms of duration, frequency, danger, and available support structures. However, a study by Hiew (1992) provides some evidence that findings from a military population may apply, at least in part, to the civilian population. Hiew (1992) directly compares military and civilian parental absences by estimating the effects of deployments in the Canadian military as well as employment-induced separation of fathers in Japan on children's behavioral outcomes. He finds that both military and civilian parental absences result in comparable stress levels, behavioral problems, and correspondingly poor attitudes toward academic achievement for elementary-age children.

Apart from the comparability between military children and civilian children, the question of how military labor force requirements affect military families is a timely issue of first-order importance for the military and society as a whole. The U.S. Department of Defense is the second-largest employer in the United States, and approximately 60% of the country's 2.4 million active-duty and reserve soldiers have children.[16] Little is known about how these children will respond to the longer, widespread, recurrent, and increasingly hazardous deployments of their military parents necessi-

[15] In table A3 in the appendix, I provide estimates from specifications that include both parental absence and household relocation variables in the same regression to test for possible correlations. Comparing estimates in cols. 1–4 reveals very little correlation between parental absences and household relocations. I also test for correlations between parental absence and time in Texas in cols. 5–7 and find no evidence of a substantive correlation.

[16] Estimates are based on 2002 data from the Directorate for Information Operations and Reports, Office of the Secretary of Defense.

tated by the ongoing Global War on Terror. Understanding these effects also has implications for assessing the costs of conscription, a policy that has repeatedly resurfaced over the course of history in times of war.

A related issue is whether the effects of parental absences and household relocations should be seen as economically important. At first glance, the fairly small magnitude of the negative effects found in this study suggests that parental absences and household relocations had little impact on the educational achievement of military children in the late 1990s. However, since human capital development is a building process, a child who falls behind in one year may fall further and further behind with subsequent years of education. A small educational setback in the third grade could become quite substantial by the twelfth grade. Although the scope of this study precludes a complete assessment of this issue, a natural avenue for future research would employ a longitudinal study to explore how absences and relocations affect children's academic achievement over time.

Appendix

Table A1
Covariate Correlations with Parental Absences

			A. Deployed ≥ 3 Months in the Current School Year		B. Deployed 1–6 Months in the Past 4 Years		C. Deployed ≥ 7 Months in the Past 4 Years		D. One-Third of Unit Deployed ≥ 3 Months	
	Enlisted Mean	Officer Mean	Enlisted (1)	Officer (2)	Enlisted (1)	Officer (2)	Enlisted (1)	Officer (2)	Enlisted (1)	Officer (2)
Male child	.515	.513	.000	−.003	.005	−.018	−.010	−.017	−.002	−.004
	{.500}	{.500}	(.004)	(.008)	(.007)	(.014)	(.006)	(.011)	(.004)	(.007)
White child	.439	.788	.004	−.012	.024	.012	−.012	−.013	.002	−.025
	{.496}	{.409}	(.005)	(.010)	(.008)	(.017)	(.006)	(.014)	(.005)	(.010)
Parents married	.902	.928	.021	.003	.031	.043	.019	.022	.020	−.004
	{.297}	{.258}	(.005)	(.013)	(.010)	(.017)	(.007)	(.012)	(.005)	(.013)
Father is in the army	.872	.908	.043	.051	.082	.110	.042	.071	.050	.045
	{.334}	{.290}	(.004)	(.008)	(.008)	(.013)	(.006)	(.008)	(.004)	(.008)
Army parent is a high school graduate	.448		.022		.053		.018		.024	
	{.497}		(.004)		(.008)		(.006)		(.005)	
Army parent has some college	.549	.137		.061		.009		.026		.056
	{.498}	{.344}		(.016)		(.020)		(.019)		(.015)

Army parent AFQT (top 40%)	.275		−.004		−.008		−.014		.001	
	{.446}		(.005)		(.009)		(.007)		(.005)	
Child in fourth grade	.169	.156	.000	−.001	−.008	.033	.015	−.010	−.009	.001
	{.375}	{.363}	(.008)	(.015)	(.010)	(.019)	(.008)	(.016)	(.008)	(.014)
Child in fifth grade	.160	.150	−.007	.000	−.014	.033	.011	−.012	−.010	−.005
	{.366}	{.357}	(.008)	(.015)	(.012)	(.022)	(.009)	(.018)	(.008)	(.013)
Child in sixth grade	.152	.152	−.012	.011	−.027	.023	.003	−.014	−.015	.005
	{.359}	{.359}	(.008)	(.016)	(.012)	(.022)	(.009)	(.018)	(.008)	(.014)
Child in seventh grade	.141	.138	−.012	.002	−.016	.065	.000	.007	−.015	.005
	{.348}	{.345}	(.008)	(.016)	(.012)	(.024)	(.009)	(.020)	(.008)	(.014)
Child in eighth grade	.125	.136	−.016	.009	.031	.038	−.005	−.005	−.018	.007
	{.331}	{.342}		(.016)		(.023)		(.019)		(.015)
Child in tenth grade	.096	.122	−.014	.000	−.015	.032	.010	−.012	−.022	.004
	{.294}	{.327}	(.009)	(.016)	(.013)	(.023)	(.010)	(.019)	(.009)	(.015)
Intercept			.029	.010	−.003	−.051	.008	.008	.040	.029
			(.007)	(.015)	(.012)	(.020)	(.010)	(.019)	(.008)	(.014)
R^2			.03	.02	.02	.02	.01	.01	.04	.02
Observations	11,311	2,900	11,311	2,900	10,891	2,873	10,891	2,873	11,311	2,900

NOTE.—Dependent variable is dummy variable for absent during period. Standard deviations (in curly braces in first two columns) are those of the means of all characteristic variables. Standard errors (in parentheses in remaining columns) account for clustering at the individual-child level because some children appear in both years. All regressions contain a year dummy for the year 1998. Means and standard deviations are calculated using data from panel A. See note in table 1 for sample description.

Table A2
Covariate Correlations with Household Relocations

			A. Moved 3–4 Times		B. Moved ≥ 5 Times	
	Enlisted Mean	Officer Mean	Enlisted (1)	Officer (2)	Enlisted (1)	Officer (2)
Male child	.516	.517	.009	−.024	.017	.030
	{.500}	{.500}	(.012)	(.023)	(.010)	(.022)
White child	.428	.818	.003	−.040	−.016	−.006
	{.495}	{.386}	(.013)	(.030)	(.011)	(.028)
Parents married	.932	.966	−.023	−.173	−.043	.083
	{.251}	{.182}	(.026)	(.065)	(.022)	(.051)
Father is in the army	.918	.953	.044	.181	.159	.211
	{.274}	{.211}	(.024)	(.060)	(.019)	(.044)
Army parent is a high school graduate	.446		−.012		−.042	
	{.497}		(.012)		(.010)	
Army parent has some college	.554	.116		.031		.048
	{.497}	{.320}		(.035)		(.034)
Army parent AFQT (top 40%)	.249		.042		−.051	
	{.432}		(.014)		(.013)	
Child in fourth grade	.169	.159	.063	.020	.086	.066
	{.375}	{.366}	(.015)	(.032)	(.011)	(.028)
Child in fifth grade	.162	.150	.089	−.044	.173	.177
	{.369}	{.357}	(.017)	(.037)	(.013)	(.033)
Child in sixth grade	.153	.153	.062	−.048	.210	.238
	{.360}	{.360}	(.018)	(.036)	(.014)	(.034)
Child in seventh grade	.141	.135	.023	−.135	.313	.341
	{.348}	{.342}	(.018)	(.039)	(.015)	(.035)
Child in eighth grade	.127	.139	−.037	−.135	.404	.320
	{.333}	{.347}	(.019)	(.037)	(.016)	(.035)
Child in tenth grade	.095	.122	−.030	−.146	.422	.340
	{.293}	{.327}	(.020)	(.039)	(.018)	(.036)
Intercept			.445	.562	.029	−.113
			(.027)	(.070)	(.022)	(.055)
R^2			.01	.03	.11	.08
Observations	10,121	2,502	10,121	2,502	10,121	2,502

NOTE.—Dependent variable is dummy variable for household relocation effect. Standard deviations (in curly braces in first two columns) are those of the means of all characteristic variables. Standard errors (in parentheses in remaining columns) account for clustering at the individual-child level because some children appear in both years. All regressions contain a year dummy for the year 1998. See note in table 6 for sample description.

Table A3
Specification Test for Parental Absence and Household Relocation Correlations

	Enlisted Parent						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Absent ≥ 3 months	-1.133	−.592		−.642	.113		.017
	(.507)	(.605)		(.605)	(.681)		(.673)
3–4 moves			−.561	−.559			
			(.352)	(.352)			
≥ 5 moves			−1.204	−1.212			
			(.412)	(.412)			
Child is taking TAAS exam for the second time						3.073	3.073
						(.389)	(.389)
Child is taking TAAS exam for the third time						4.776	4.775
						(.535)	(.535)
R^2	.05	.05	.05	.05	.05	.07	.07
Observations	11,311	10,306	10,306	10,306	7,178	7,178	7,178

NOTE.—Dependent variable is Texas Learning Index score for mathematics. Standard errors (in parentheses) account for clustering at the individual-child level because some children appear in both years. All regressions contain a constant and dummies for the year 1998, grades 4–8 and 10, child's gender, child's race, parent's marital status, military parent's gender, military parent's education level, and military parent's AFQT quintile (enlisted only). See table 8 note for a description of the matching procedure. See notes in tables 1 and 6 for additional sample description.

References

Altonji, Joseph, Todd Elder, and Christopher Taber. 2000. Selection on observed and unobserved variables: Assessing the effectiveness of Catholic schools. NBER Working Paper no. 7831, National Bureau of Economic Research, Cambridge, MA.

Angrist, Josh, and John Johnson. 2000. Effects of work-related absences on families: Evidence from the Gulf War. *Industrial and Labor Relations Review* 54, no. 1:41–58.

Davey, Monica. 2004. The new military life: Heading back to the war. *New York Times*, December 20.

Fields, Jason, and Lynne Casper. 2001. American families and living arrangements. Current Population Reports, U.S. Census Bureau, Washington, DC.

Haveman, Robert, and Barbara Wolfe. 1993. Children's prospects and children's policy. *Journal of Economic Perspectives* 7, no. 4:153–74.

———. 1995. The determinants of children's attainments: A review of methods and findings. *Journal of Economic Literature* 33, no. 4:1829–78.

Heinlein, Lisa M., and Marybeth Shinn. 2000. School mobility and student achievement in an urban setting. *Psychology in the Schools* 74, no. 4: 349–57.

Hiew, C. 1992. Separated by their work: Families with fathers living apart. *Environment and Society* 24, no. 2:206–25.

Jensen, Peter, David Martin, and Henry Watanabe. 1996. Children's response to parental separation during Operation Desert Storm. *Journal of the American Academy of Child and Adolescent Psychiatry* 35, no. 4:433–41.

Marchant, Karen, and Fred Medway. 1987. Adjustment and achievement associated with mobility in military families. *Psychology in the Schools* 24:289–94.

McLanahan, Sara, and Gary Sandefur. 1994. Growing up with a single parent: What hurts, what helps. Cambridge, MA: Harvard University Press.

Nearin, Lynn, and Robert Segal. 2002. Military families prepare for possible war with Iraq. National Public Radio, November 11.

Piaget, Jean. 1977. Moral judgment: Children invent the social contract. In *The essential Piaget*, ed. H. Gruber and J. Jacques Vonèche. New York: Basic.

Pisano, Mark Charles. 1992. The children of Operation Desert Storm: An analysis of California Achievement Test Scores in sixth graders of deployed and nondeployed parents. PhD diss., Campbell University.

Schachter, Jason. 2001. Geographic mobility. Current Population Reports, U.S. Census Bureau, Washington, DC.

Taubman, Paul. 1989. Role of parental income in educational attainment. *American Economic Review* 79, no. 2:57–61.

Texas Education Agency. 2000. Texas Student Assessment Program: Technical digest. Austin: Texas Education Agency.

U.S. Bureau of the Census. 1980, 1990, 2001. *Statistical Abstract of the United States*. Washington, DC: U.S. Government Printing Office.

U.S. Bureau of the Census. 1996, 1999, 2000. *Current Population Reports from the CPS*. Washington, DC: U.S. Government Printing Office.

U.S. General Accounting Office. 1994. *Elementary school children: Many change schools frequently, harming their education*. GAO/HEHHS-94-45, 1–55. Washington, DC: Health, Education, and Human Services Division.

Weisenberg, M., J. Schwarzwald, M. Waysman, Z. Solomon, and A. Klingman. 1993. Coping of school age children in the sealed room during scud missile bombardment and postwar stress reactions. *Journal of Consulting and Clinical Psychology* 61:462–67.