Article:
Kouki, A. (2023) Beyond the "comforts" of work from home: child health and the female wage penalty. European Economic Review, 157. 104527. ISSN 0014-2921

https://doi.org/10.1016/j.euroecorev.2023.104527

Beyond the "Comforts" of Work from Home: Child Health and the Female Wage Penalty

AMAIRISA KOUKI*

ABSTRACT

Using data on American women and the health status of their children, this paper provides estimates of the effect of remote work on female wages. A temporary child health shock, which does not affect a woman's labor market outcomes beyond inducing her to work at home, is used as an instrument. Instrumental variable estimates indicate a substantial wage penalty that is more likely attributed to women's choices or assignments of less promotable job tasks when working from home. The findings are valuable in assessing the costs associated with remote flexibility, especially when children are required to stay at home during episodes of illness.

Keywords: *female wages, remote work, fertility, child health, instrumental variables*
JEL Classification: *C26, C36, J13, J16, J22*

*Department of Economics, Nottingham Business School, Nottingham Trent University, 50 Shakespeare St, Nottingham NG1 4FQ, UK (email: amairisa.kouki@ntu.ac.uk). The author declares that there is no financial or other interest that relates to the research described in this paper.

1 INTRODUCTION

The potential effect of working from home on women's wages has received considerable attention well before the onset of the pandemic. Remote work may offer benefits such as improved flexibility in reconciling work around family schedules and reduced commuting time and costs. Theoretically, these benefits might be associated with compensating wage differentials in the form of lower wage rates in a competitive framework. Less effective networking, reduced social participation and interaction with co-workers, along with lower productivity resulting from remote work may also contribute to reduced earnings, while the desire to work from home may also signal to employers a lack of commitment to the job, potentially impeding career advancement (Williams, 2000; Blair-Loy, 2006; Williams et al., 2013; Allen et al., 2015).

Despite various theoretical explanations for a potential negative association between remote work and earnings, relevant empirical evidence remains limited and mixed. Evidence by Glass and Noonan (2016) suggests that remote work has a modest positive effect on earnings during regular working hours compared to overtime. Other studies focus on specific employees and identify positive effects of remote work on productivity (see Bloom et al. (2015) for China and Emanuel and Harrington (2021) for the U.S on the effects of remote work among call-center employees). In contrast, Golden and Eddleston (2020) find that telecommuters, in comparison to non-telecommuters, have slower salary growth among a sample of professional employees working in a technology services company with nationwide locations in the U.S. Bertrand et al. (2010) demonstrate an adverse effect on the earnings of female MBA graduates when they opt for jobs that offer remote work or flexible working hours, with penalties ranging from 20 to 60 percent.

In this paper, the relationship between wages and remote work is examined by using nationally representative data on women from the National Longitudinal Survey of Youth (NLSY79) and their children in the NLSY79 Child and Young Adult Survey (NLSCYA). An Instrumental Variable (IV) approach is employed to identify and estimate the effect of remote work on women's wages. For this purpose, a sudden and temporary child health problem is used as an instrumental variable. To the extent that such a health issue is a valid instrument, it causes exogenous variation in the propensity to work from home. The IV approach enables the estimation of the causal effect of remote work on women's wages, while effectively addressing potential biases arising from unobserved omitted variables

that change over time and reverse causality.

Working from home had already become a prominent economic phenomenon in the U.S. prior to the COVID-19 pandemic. Dingel and Neiman (2020) estimate that approximately 37 percent of all jobs in the country can be fully performed remotely, while these jobs account for 46 percent of all wages. Mongey et al. (2020) show that individuals that are less able to do tasks at home are more likely to have lower incomes. Other researchers focus on how women's labor market outcomes have been disproportionately affected by the pandemic due to increased childcare needs compared to men (Alon et al., 2020a; Alon et al., 2020b; Albanesi and Kim, 2021; Alon et al., 2021; Goldin, 2022). Adding to the evidence about the unequal gendered impact of the pandemic, Adams-Prassl et al. (2020) suggest that women take on a higher share of childcare responsibilities, even while working remotely.

Amidst the changing nature of work post-pandemic, significant attention has been given to the adoption of hybrid models that offer a blend of remote and in-person office work. Indicatively, more than four out of five of those who experienced hybrid work models during and after the pandemic express a preference for retaining them in the future (Dowling et al., 2022). As long as remote work is anticipated to remain prevalent, there is an increasing emphasis on evaluating the benefits and challenges of these new models, particularly in terms of productivity and career advancement. The future of most offices is at a turning point, as hybrid work is viewed as having the potential to address the needs of working mothers who mainly bear the burden of childcare responsibilities, especially during child illnesses. Therefore, the relationship between remote work, child health shocks, and wages for women prior to the pandemic should be relevant in assessing the impact of this flexible work arrangement in the post-pandemic era.

The NLSCYA is particularly valuable in this context as it contains detailed health information for each child born to female respondents in NLSY79. This enables the creation of the child health instrument. The logic of the instrument is that a temporary health shock experienced by a child would render remote work more desirable, allowing the mother to attend to the child's needs with greater flexibility. The key assumption for identification is that, after accounting for standard wage determinants, the child health shock does not have an impact on a woman's wages other than inducing her to work more from home for a potentially limited duration. The findings from alternative regressions provide evidence for the unexpected nature of the temporary child health problem and its indirect effect on wages by increasing the likelihood of the mother working from home. These findings

provide support for the validity of the exclusion restriction and the exogeneity of the instrument.

The main results of the study suggest that there is a statistically significant wage penalty for women who work from home. Based on Ordinary Least Square (OLS) estimates, working from home leads to a decrease in mean hourly wage of 8.2 percent. Taking advantage of the longitudinal aspect of the data, the FE estimate reveals a more substantial wage penalty of 12.2 percent. The IV estimate that includes fixed effects and exploits the child health instrument results in an even more significant wage penalty of 68.9 percent.

The IV estimate is local average treatment effect which pertains to working mothers who work from home in response to a temporary child health shock. The substantial size of the IV estimate compared to OLS and FE estimates implies positive selection into working from home among this particular subsample of women. Positive selection, in conjunction with results from alternative first-stage regressions, suggest that the wage penalty faced by women who work remotely may be more plausibly attributed to higher skilled women that experience decreased productivity and slower career advancement due to being assigned or choosing tasks with low promotability.

The rest of the paper is structured as follows. Section 2 describes the data, provides OLS and FE estimates of the wage penalty and describes the child health instrument. Section 3 outlines the IV estimation framework. Section 4 reports reduced-form and IV estimates of the wage penalty. Section 5 discusses the magnitudes of the estimates, explores potential pathways underlying the wage penalty, and assesses the validity of the instrument. Section 6 summarizes and concludes.

2 DATA

The NLSY79 is a nationally representative sample of young men and women aged 14 to 22 years and living in the U.S. when they were first surveyed in 1979. Participants were interviewed annually until 1994 and biennially from 1994 onward. The NLSY79 gathers data and allows tracking of event histories related to respondents' education, labor market experience, marital status and family background.[1]

[1] The sample originally included 12,686 respondents. It contained a cross-section of 6,111 individuals of which 3,108 were women and 3,003 were men. There was also a set of supplemental samples designed to increase the representation of civilian Hispanics or Latinos, Blacks, the economically disadvantaged, non-Black/non-Hispanic youths (5,295 in total) and a military oversample designed to increase the representation of those serving in the military as of September 30, 1978 (1,280 in total). More information on NLSY79 can be found here. The sample in this analysis is restricted to the cross-section sample of women only, aligning in this way with the NLSCYA surveys that provide information about the children of NLSY79 female respondents.

The NLSY79 introduced questions on the number of hours per week usually worked at home starting in 1988. In this paper, the focus is on employed females who are 24 to 55 years old between the years 1988 and 2012. Only white women who have finished their education are included in the sample.[2] Women with incomplete observations on their marital status and fertility history, inconsistent schooling information, and missing information on occupation (missing census code) and wage are excluded. Because fixed effects regressions are estimated, the requirement is more than one year of employment attachment for each individual in the sample. After implementing standard sample exclusion restrictions, the estimation sample consists of 1,607 women and 17,374 women-year observations.

The NLSCYA contains information on the biological children of female NLSY79 respondents. These children have been assessed and interviewed every two years since 1986. For consistency with the NLSY79, children are followed after 1988. Information about a child's health is first provided by the mother. As the child ages, the health information becomes self-reported. The questions on health conditions in the NLSCYA enable the creation of health histories for the children of NLSY79 female respondents. The temporary health problems considered include limiting health conditions, accidents and injuries requiring medical attention or hospitalization, emotional and behavioral problems, as well as utilization of specialized medical equipment and services. The number of children in the sample is 2,980.

Reported weekly employment histories are used to compile annual information. Total annual hours worked for each female in the sample are defined as the sum of weekly hours worked on site (job location is outside of the home) and weekly hours worked at home. Respondents in the NLSY79 can report up to five employers. If more than one employer is identified, only the hourly wage and annual hours worked at the main job are considered. A woman is defined as employed if she reports working at least 10 hours per week, or 520 hours annually. If the sum of annual hours is less than 520, she is also determined to be employed if she worked more than 260 hours in total and reported more than 30 hours weekly. For consistency with the employment data, the hourly rate of pay at the time of the interview is considered.

Most of the women in the sample do not work exclusively at home. The distribution of

[2] The focus is on white women, as there may be substantial heterogeneity among different racial groups in terms of educational attainment, socioeconomic status, occupational choice, and other factors that affect the likelihood of working from home and wages (Keane and Wolpin, 2010).

remote work hours shows that 91.3 percent of women work at home less than 1,560 hours per year (30 hours per week on average) and 70 percent less than 520 hours (10 hours per week on average). Table 1 displays the mean hours worked at home, excluding zeros, at selected ages. The mean hours worked at home is 500. This is equivalent to a little less than two days a week of remote work.[3] Column (1) demonstrates an increase in the average hours worked from home up to the age of 40.

Table 1 also presents the proportion of women that work at home and mothers with at least one child under 18. Across all ages, the overall rate of working from home is 17.2 percent.[4] Column (2) shows a declining trend in the proportion of women working from home as age increases, starting from a peak of 21.7 percent at age 25 and reaching a low of 13.5 percent at age 55. Column (3) reveals an inverted u-shape in the proportion of mothers. This proportion is 33.1 percent at age 25, reaches a maximum of 77.9 percent at age 35, and then falls to reach a low of 7.9 percent at age 55.

Table 1: Mean Hours Worked at Home and
Proportion of Working at Home and Mothers at Selected Ages

Woman's Age	Hours Worked at Home (1)	Work at Home (2)	Mothers with Child < 18 (3)	*N* (4)
25	314.94	.217	.331	290
30	456.61	.197	.614	888
35	574.37	.166	.779	809
40	585.69	.141	.759	611
45	532.53	.155	.562	534
50	517.14	.158	.267	354
55	563.58	.135	.079	89
Total	500.00	.172	.612	17,374

Note: *N* is the number of observations at each age. Total refers to all ages between 24 and 55. The hours worked at home exclude zero hours.

The patterns in Columns (1) - (3) do not suggest a strong correlation between remote work and motherhood. If this was the case, one would anticipate an increase in the hours and the proportion of women working from home as the proportion of mothers increases.

[3] On average, those who worked at their workplace did so for 7.8 hours on days they worked, and those who worked at home did so for 5.6 hours in 2021 (see American Time Use Survey - 2021 Results).
[4] Before the pandemic, 19.5 percent of women aged 15 years and over worked 1 to 2 days exclusively at home (see Bureau of Labor Statistics – Economic News Release).

Similarly, as the proportion of mothers decreases again, one would expect a more rapid decrease in the hours and proportion of women working from home. Neither of these patterns is evident from Table 1. This suggests that other factors, such as the health status of children, may affect the propensity to work from home.

Table 2 displays sample means and differences in means by work location (at home vs. on site). The figures illustrate that women who work at home any positive number of hours tend to be more highly educated, are more likely to work in professional, technical or managerial roles, and work more hours. In addition, they are more likely to be married and have higher wages. Based on raw correlations, working at home is associated with a wage premium of 9.4 percent rather than a wage penalty.

Table 2: Sample Means

	Full Sample (1)	Work at Home (2)	Work on Site (3)
Age	37.05	36.28	37.21
$hgc < 12$	.060	.019	.068
$12 \leq hgc < 16$	.729	.560	.764
$hgc \geq 16$	.211	.422	.167
Professional, Technical and Managerial	.337	.561	.291
Sales and Clerical	.358	.229	.384
Services, Craftsmen, Operatives and Laborers	.305	.210	.325
Total Hours $\leq 1,040$	.158	.142	.162
$1,040 <$ Total Hours $\leq 1,560$	.166	.145	.171
$1,560 <$ Total Hours $\leq 2,080$	.448	.220	.496
Total Hours $> 2,080$	.227	.493	.172
Married	.708	.738	.702
Log Hourly Wage	2.544	2.622	2.528
N	1,607	843	1,556
NT	17,374	2,986	14,388

Note: The figures are averages in the pooled sample and the subsamples of those working at home and on site. N is the number of women. NT is the number of woman-year observations. hgc is the highest grade completed. Total hours is the sum of hours worked on site and at home in a calendar year. Wages are hourly wages from the main job earned by an employee in a calendar year. Wages are deflated using the CPI index with a base year of 2005.

2.1 OLS AND FE ESTIMATES

OLS and FE estimates of the impact of working at home on mean wages are presented

in Table 3. Column (1) of Table 3 includes only an indicator for working at home. This specification, estimated by OLS, yields a precisely estimated remote work wage premium of 9.4 percent (as indicated by the unconditional correlation in Table 2).

Table 3: OLS and Fixed Effects Estimates of the Wage Penalty

	Log of Hourly Wage		
	(1)	(2)	(3)
Work at Home	.094	-.082	-.122
	(.028)	(.024)	(.019)
$I(12 \leq hgc < 16)$		.164	
		(.033)	
$I(hgc \geq 16)$		.489	
		(.040)	
$I(1,040 < \text{Total Hours} \leq 1,560)$		.039	.018
		(.017)	(.014)
$I(1,560 < \text{Total Hours} \leq 2,080)$		.223	.099
		(.018)	(.013)
$I(\text{Total Hours} > 2,080)$		.252	.085
		(.022)	(.016)
Professional, Technical		.384	.144
and Managers		(.022)	(.017)
Sales and Clerical		.184	.056
		(.019)	(.016)
Other regressors	No	Yes	Yes
Fixed Effects	No	No	Yes
Adjusted R^2	.004	.241	.093

Note: Clustered standard errors at the individual level in parentheses. The number of women is 1,607. The number of woman-year observations is 17,374. The dependent variable is the natural log of hourly wage in constant 2005 dollars. Work at Home is an indicator for having worked at home during the survey year. *hgc* is the highest grade completed. Total hours refer to the sum of hours worked on site and at home in a calendar year. Other regressors include age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18 in the household.

In Column (2), controls are added, including education, total hours worked, occupation, marital status, spousal income and number of children. The OLS estimates in Column (2) now reveal a wage penalty. Working at home is associated with a decrease in mean wages of 8.2 percent. The estimates in Column (2) also show that mean hourly wages increase significantly with the level of education, total hours worked and being employed in a professional, technical or managerial occupation, as well as being employed in a sales or a clerical position.

Column (3) reports FE estimates which take advantage of the longitudinal aspect of the

data. Eliminating time-invariant unobserved individual characteristics and controlling for time-varying observed heterogeneity, a precisely estimated wage penalty of 12.2 percent is obtained. This constitutes a 48.8 percent increase in the wage penalty compared to the OLS estimate in Column (2). The other time-varying controls are considerably reduced in magnitude, in comparison to OLS, though most remain statistically significant.

2.2 THE CHILD HEALTH INSTRUMENT

The OLS and FE estimates of the effect of remote work on wages may suffer from biases due to unobserved omitted variables that change over time and reverse causality. Employing an IV approach can potentially mitigate such biases. Despite the primary focus being on the relationship between a temporary child health problem and remote work, I draw on the extensive literature on permanent child health issues and maternal labor market outcomes to establish the theoretical foundations and introduce the concerns regarding instrument's construction and validity.

Having children in poor health can impose time and financial burdens on mothers. Multiple studies have consistently established a negative correlation between disabilities or chronic conditions and maternal employment (a more detailed review of earlier studies can be found in Powers (2003)). Marital status has been found to significantly impact female employment choices when a child is severely ill. Married mothers whose children had a serious health condition characterized by an unpredictable time component were less likely to work and worked fewer hours (Gould, 2004).

Luca and Sevak (2018) find that mothers' hours of work decline prior to the diagnosis of a disability in their child, followed by a decrease in their labor market participation after the diagnosis. Additionally, their research reveals an increased likelihood of mothers receiving support from public assistance programs subsequent to the diagnosis. Child disabilities have been shown to influence more low-income mothers' hours of work (Wolfe and Hill, 1995) and job turnover (Earle and Heymann, 2002). The negative effects of poor child health on maternal labor supply are strongest for unmarried mothers, who face increasing pressure to rely on earnings from work rather than government assistance (Corman et al., 2005).

Wehby and Ohsfeldt (2007) find a negative impact of child disability on maternal employment and test the exogeneity of specific disability measures, finding them endogenous for white mothers. Richard et al. (2014) account for endogeneity in children's health using alternative instruments and show that having a child between the age of 4 and

18 with emotional and behavioral problems negatively influences married mothers' probability of employment and single mothers' hours of work. Using five waves of a sample of children aged 4 and 5 years old at the start of the survey and an instrumental variable approach, Lafférs and Schmidpeter (2021) identify a negative and significant impact of poor early child development on maternal weekly hours and earnings.

Children's permanent health conditions have been used before as instruments in research focusing on examining the labor market response of mothers to the presence of a child with severe health problems. The results from these studies are substantially different without instrumenting. Powers (2001) considers the child disability as endogenous and uses 11 impairment categories to instrument the parental assessment of children's functional disability, assuming that the impairments are important determinants of the childcare burden but do not directly interfere with parental labor supply. The study finds that the effect of child disability on maternal labor supply is insignificant for married women and negative and more severe for female household heads. Zan and Scharff (2018) use a variety of chronic health conditions to instrument the financial and time health-related costs of children under 18 years old. Assuming that children's health problems affect their mothers' employment only through health-related financial and time caregiving burdens, they show that mothers are more likely to participate in the labor market with a higher monetary caregiving burden, and less likely to participate with a higher time caregiving demand.

Previous studies have only considered chronic conditions in analyzing the impact of children's health on maternal employment outcomes. The logic of the instrument in this study is different. The aim is to estimate the causal effect of remote work on wages using a temporary child health problem as an instrument. In this context, it is crucial for the instrument to create exogenous variation in the propensity to work from home. The key identifying assumption is that after controlling for a comprehensive set of standard determinants of wages and including unobserved fixed effects, the child health shock does not affect the mother's wages beyond inducing her to work at home, for what might be a limited amount of time.[5] The local average treatment effect produced by IV regression pertains only to women who work at home due to a child's health becoming suddenly and temporarily compromised.

To construct the child health instrument, I have accounted for a wide range of health

[5] There is no statistically significant difference in the occurrence of temporary health problems when mothers are employed compared to when they are not.

problems that result in temporary limitations in activities and restrictions in participation, as well as injuries and accidents that require medical attention or hospitalization. In NLSCYA, mothers and later the children themselves are asked whether the child has a condition that limits school attendance, schoolwork, and childhood activities, or requires medical attention, medication or special equipment. The survey also collects information about the specific type and duration of the condition. Additionally, mothers are asked about whether their children had accidents, injuries, or illnesses that demanded medical attention or resulted in hospitalization. Furthermore, they are requested to provide the timing of the three most recent incidents of injuries and accidents. Responses about disabilities, serious behavioral issues, mental or emotional conditions are also considered for the construction of the instrument.

The questions about the duration of limitations and the timing of injuries or accidents in the NLSCYA help capture the timeline during which a child's functioning is affected. For consistency with NLSY79 and maternal histories, a child health problem is considered temporary if it occurs within a span of one year. Limitations, accidents, injuries, and mental conditions, as described above, with a duration that exceeds one year or health issues that arise as a result of another disability or coexist with another permanent health condition are not considered temporary and excluded from the analysis.

Table 4 presents the proportion of children with a temporary health problem at each child age (less than or equal to 18). A maximum of four children per mother are considered. The overall prevalence of a child with a temporary health problem is 12.3 percent.[6] The proportion of mothers in the sample that have at least one child with a temporary health problem is 15.7 percent.

[6] Prevalence (or prevalence rate) is defined as the proportion of persons in a population who have a particular condition over a specified period of time. In this dataset, the prevalence rate of injuries or accidents is 12 percent, while the prevalence rate of temporary limitations is 0.08 percent. Zonfrillo et al. (2018) identify a total of 7.5 million injury-related emergency department visits and hospitalizations for children between 0 and 17 years of age in 2013 in the U.S; this represents around 10.2 per 100 children in this age range (see U.S. Census Bureau for the total number of children under 18). The combined prevalence rate of both permanent and temporary health conditions is 38.8 percent in this sample. Different reports use different data and criteria to define the level of limitation or disability. According to Bethell et al. (2011),who use data from the 2007 National Survey of Children's Health, in children younger than 17, the prevalence of chronic conditions is 43 percent and reaches 49.9 percent for moderate or severe conditions (as rated by parent greater than mild). The percentage of children with a disability increased between 2008 and 2019, from 3.9 percent to 4.3 percent (see Childhood Disability in the U.S.: 2019). Approximately half of children with disability were classified with severe disabilities (see American with Disabilities:2010 and Americans with Disabilities: 2014). Data from the Survey of Income and Program Participation (SIPP) shows that the prevalence of non-severe and severe disability, as defined by the difficulty performing a specific set of functional and participatory activities, for children under 15 was 8.4 percent in 2010. The Social Security Administration Supplement (SSA) to the 2014 Panel of the SIPP considers children to have a severe disability if they used a wheelchair, a cane, crutches, or a walker; were blind or deaf; if they had difficulty having their speech understood or had difficulty with one or more activities of daily living; or had a developmental delay, an intellectual disability, a developmental disability such as cerebral palsy or autism, or some other developmental condition; among children aged 5 to 17 years, the proportion of those with non-severe disabilities was 9.1percent, while those with severe disabilities accounted for 11.7 percent in 2014.

Note that pre-school children (less than 7 years of age) are more likely to experience a temporary health problem. This is consistent with evidence for the U.S. and other countries that pre-school children spend more time at home, and the home is the leading location of accidents for young children (Pauline et al., 2007; Phelan et al., 2011). In the regression analysis that follows, a child health problem is represented by a dummy variable which equals one if at least one child is temporarily afflicted and equals zero otherwise.

Table 4: Proportion of Children with a Temporary Health Problem by Age

Child's Age	Health Problem	*N*
0	.081	1,462
1-2	.268	3,416
3-4	.201	4,133
5-6	.169	4,727
7-8	.143	5,272
9-10	.115	5,612
11-12	.097	5,739
13-14	.090	5,705
15-16	.058	5,498
17-18	.057	5,175
Total	.123	46,739

Note: *N* is the number of children observations at each age.

3 IV FRAMEWORK

The child health instrument is exploited within the framework of a two-stage least squares model that estimates a linear relationship between the log of the hourly wage of woman i at time t, $Y_{i,t}$, and working at home at time t, $R_{i,t}$,

$$Y_{i,t} = \alpha_i + \beta_1 R_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t}, \quad (1)$$

where α_i is an unobserved individual fixed effect, $X_{i,t}$ is a vector of time-varying individual characteristics including age, age squared, indicators for total hours worked, marital status, different occupational categories and the number of children in the household. $\varepsilon_{i,t}$ is an individual-specific productivity shock in each year t. This is the same set of controls used in the OLS and FE estimations presented earlier.

The first-stage equation in the two-stage least squares procedure is

$$R_{i,t} = \gamma_i + \delta_1 H_{i,t} + \delta_2 X_{i,t} + \eta_{i,t}, \quad (2)$$

where γ_i is an unobserved individual fixed effect, $H_{i,t}$ is the child health instrument and $\eta_{i,t}$ is an individual-specific error term in each year t that may be correlated with $\varepsilon_{i,t}$ in Equation (1).

As mentioned earlier, the key identifying assumption is that a child's temporary health issue increases the propensity to work at home but does not directly influence wages, after controlling for observable determinants of wages and unobservable time- invariant productivity characteristics. The IV estimates have a causal interpretation as long as the association between children's health and wages is exclusively due to the association between children's health and the decision to work remotely. The main identification challenge arises from the possible impact of children's health on wages through alternative pathways such as the choice of working hours and occupation, and through the unobserved determinants of earnings captured by $\varepsilon_{i,t}$. In order to address these threats to identification, flexible specifications for hours worked as well as indicators for different occupational categories are included in the regressions. Alternative first-stage regressions and validity tests are also performed to more firmly establish the exogeneity of the instrument.

4 ESTIMATION RESULTS

4.1 REDUCED FORM ESTIMATES

Table 5 presents reduced-form estimates of the effect of a temporary child health problem. The same set of covariates are used as in the OLS and FE regressions in Table 3. Columns (1) and (2) of Table 5 display first-stage estimation results without and with fixed effects, respectively.

In both Columns (1) and (2), the coefficient for a temporary child health problem is large in magnitude and statistically significant. A temporary child health problem substantially increases the probability of working at home. The increase in the probability is 5.3 percent without fixed effects and 3.8 percent with fixed effects. These are large magnitudes considering that the mean proportion that work at home in the sample is 17.2 percent. The *F-statistics* in Column (1) and Column (2) indicate that the instrument is both relevant and strong.

Columns (3) and (4) show a precisely estimated negative effect of a temporary

child health problem on mean hourly wages. Mean wages are lower by 1 percent without fixed effects and 2.6 percent with fixed effects. The ratio of the coefficients corresponding to the temporary child health variable in Table 5 already indicates that the IV estimates of the wage effect of working at home will be negative and quite substantial in magnitude.

Table 5: Reduced Form Estimates

	Work at Home		Log of Hourly Wage	
	(1)	(2)	(3)	(4)
Child Health Problem	.053	.038	-.010	-.026
	(.010)	(.009)	(.015)	(.011)
$I(12 \leq hgc < 16)$	.059		.159	
	(.011)		(.033)	
$I(hgc \geq 16)$	.212		.471	
	(.020)		(.040)	
$I(1,040 < \text{Total Hours} \leq 1,560)$	-.001	.003	.039	.017
	(.011)	(.009)	(.017)	(.014)
$I(1,560 < \text{Total Hours} \leq 2,080)$	-.059	-.030	.227	.102
	(.010)	(.009)	(.018)	(.013)
$I(\text{Total Hours} > 2,080)$	.197	.151	.235	.066
	(.015)	(.013)	(.022)	(.016)
Professional, Technical	.078	.021	.378	.142
and Managers	(.013)	(.014)	(.022)	(.017)
Sales and Clerical	-.017	-.056	.186	.063
	(.009)	(.012)	(.019)	(.017)
Other regressors	Yes	Yes	Yes	Yes
Fixed Effects	No	Yes	No	Yes
F-statistic	30.48	18.42		
	(.000)	(.000)		
Adjusted R^2	.149	.057	.239	.084

Note: Clustered standard errors at the individual level in parentheses. The number of women is 1,607. The number of woman-year observations is 17,374. The dependent variable in Columns (1) and (2) is a dummy indicating having worked at home during the survey year. The dependent variable in Columns (3) and (4) is the natural log of hourly wage in constant 2005 dollars. *hgc* is the highest grade completed. Total hours worked is the sum of hours worked on site and at home in a calendar year. Other regressors include age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18 in the household. The *F*-statistic is for the test of excluded instruments (*P-values* in parentheses below).

4.2 IV ESTIMATES

IV estimates of the effect of working at home on hourly wages are reported in Table 6. The same set of covariates used earlier for the FE regressions in Table 3 are included. Working at home is instrumented by a temporary child health problem. The IV estimates with fixed effects presented in Table 6 demonstrate a significant and precise wage penalty that increases substantially to 68.9 percent. Similar to the corresponding fixed effects estimates in Table 3, mean hourly wages increase significantly with total hours worked and when a woman being employed in professional, technical or managerial occupations. [7, 8]

Table 6: IV Estimates of the Female Wage Penalty with Fixed Effects

	Log of Hourly Wage
Work at Home	-.689
	(.312)
$I(1,040 < \text{Total Hours} \leq 1,560)$	.019
	(.014)
$I(1,560 < \text{Total Hours} \leq 2,080)$	.081
	(.017)
$I(\text{Total Hours} > 2,080)$	.169
	(.048)
Professional, Technical	.156
and Managers	(.018)
Sales and Clerical	.025
	(.024)
Other regressors	Yes
Fixed Effects	Yes

Note: Clustered standard errors at the individual level in parentheses. The number of women is 1,607; the number of woman-year observations is 17,374. The dependent variable is the natural log of hourly wage in constant 2005 dollars. Work at Home is an indicator for having worked at home during the survey year. Total hours worked is the sum of hours worked on site and at home in a calendar year. Other regressors include age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18 in the household.

5 DISCUSSION

5.1 MAGNITUDES AND POSSIBLE PATHWAYS

The IV estimates in Table 6 are properly interpreted as local average treatment effects

[7] The coefficient of work at home for the subsample of mothers is not statistically different from the reported wage penalty.
[8] No substantial interactions with the indicator for work at home with total hours worked, occupations, age, and number of children were found, suggesting a lack of heterogenous treatment effects. These results are not reported for sake of brevity but are available upon request.

that capture the change in mean hourly wages amongst women who are induced to work at home as a result of at least one child in the household developing a temporary health issue. This subsample of women (the compliers (Angrist et al., 1996)) are those who would not have worked at home, had the child not become ill.

The local average treatment effect reported in Table 6 is more than 5 times the magnitude of the corresponding FE estimate, indicating that these latter estimates are substantially biased toward zero (under-estimated) and there is positive selection. The sample means in Table 2 are highly suggestive of positive selection on unobservables because women who work at home are, on average, more highly educated and more often work in professional, technical or managerial roles. Positive selection of mothers into remote work and flexible jobs was also indicated in the study of the gender earnings gap amongst MBA graduates by Bertrand et al. (2010) and in the study of telecommuting by Glass and Noonan (2016).

Positive selection into remote work can also help explain why the IV estimates are large in magnitude (more negative) in an absolute sense, not just relative to FE estimates. Note that effects of these magnitudes are not unprecedented in the wider literature on flexible working conditions. As mentioned earlier, Bertrand et al. (2010) find a remote work wage penalty amongst female MBA graduates of 20 percent. However, the wage penalty amongst women that choose a new job with flexible working hours is much higher reaching 60 percent. These latter estimates are produced from fixed-effects regressions on a selected sample of highly educated women. In the present study, the IV estimates are derived from more representative data on women across the entire spectrum of educational attainment.

To rule out alternative pathways other than remote work that could lead to changes in wages, Table 7 presents alternative first-stage regressions. Each panel of Table 7 shows the estimated effect of the child health shock on several outcome variables, which have been identified in literature as potentially influenced by child health issues.

Reiterating a previously discussed point, mothers may choose to reduce their working hours in response to their child facing health challenges to dedicate more time and attention to the child. Panel (A) of Table 7 reports the results of a regression where the dependent variable is an indicator for a reduction in total hours worked in the year a temporary child health issue occurs. To capture any decrease in total hours worked more accurately, I use the actual total hours worked instead of the indicators employed in previous regressions. The findings in Panel (A) indicate that a temporary health problem

does not have a statistically significant impact on total hours worked, suggesting that such shocks are unlikely to result in negative wage effects through a reduction in total hours worked.[9] Similarly, the estimates in Panel (B) show that the probability of a mother exiting the labor market due to a temporary child health shock is small in magnitude and statistically insignificant.

Table 7: Alternative First-Stage Estimates

	Child Health Problem
A. Decrease in Total Hours Worked	.009
	(.014)
B. Labor Force Exit	-.010
	(.009)
C1. Job Change 1	.018
	(.012)
C2. Job Change 2	.005
	(.008)
D. Marital Disruption	-.003
	(.005)
E. Additional Births	.009
	(.007)
Other Regressors	Yes
Fixed Effects	Yes

Note: Clustered standard errors at the individual level in parentheses. The number of women is 1,268. The number of woman-year observations is 10,593. Other regressors include indicators for total hours worked, indicators for occupation, age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18.

In Panels (C1) and (C2), two different indicators of job change are constructed by using employer and occupation information available from NLY79.[10] The first measure of a job change is an indicator for a woman switching employer, while the second measure also accounts for a change in her occupation. The estimates in both panels indicate that a temporary child health issue does not result in any notable job mobility.

[9] As discussed previously, a mother might be prompted to work longer hours in order to cover the additional expenses associated with a child's health requirements. Estimates from a regression for an increase in total hours worked show that this is not the case either.
[10] Kambourov and Manovskii (2009) use the Panel Study of Income Dynamics (PSID) to explore occupational switching.

Severe child health problems can negatively impact social relationships and increase the risk of divorce (Reichman et al., 2003) or impact a mother's potential to have more children. In Panels (D) and (E), the effect of a temporary child health problem on marital disruption and the probability of additional births is examined.[11] No significant effect of a child health shock on the mother's likelihood of staying married or her potential for giving birth is found.

The findings presented in Table 7 provide support for the exogeneity of the instrument and effectively eliminate potential pathways that could account for the significant wage penalties observed. One possible explanation for the positive selection and a large wage penalty is that women who choose to work from home following a child health shock become less productive because of choosing or being assigned "less promotable" job tasks; ones that are less likely to lead to career progression. Women have been found to occupy positions or engage in tasks that offer more limited opportunities for advancement or promotion within organizations (Babcock et al., 2017). Especially after the birth of their first child, highly educated females tend to experience a more prolonged and escalating mismatch between their skills and job requirements; concurrently, they opt for occupations that provide greater flexibility albeit at the cost of a better skill match and potentially lower wages (Addison et al., 2020).

More flexible jobs are associated with slower career progression, particularly in high-profile jobs. Mothers who hold an MBA degree may be forced or opt out of the "fast-track" after choosing more flexible work arrangements (Bertrand et al., 2010; Goldin, 2014), while women on the "mommy track"[12] might be perceived as having diminished ambition and are frequently overlooked for promotions (Azmat and Ferrer, 2017; Bear, 2021; Hospido et al., 2022). In highly competitive occupations with greater tournament or up-or-out structure, women are more likely to fall behind due to a shift in low-promotability tasks when working remotely. In this sample, a significant proportion of women (33.7 percent) work in professional, technical, and managerial positions where such employment structures are more common and associated with performance-based evaluations and aspirations for career advancement and wage growth.

In a call-center setting, Bloom et al. (2015) find that work-from-home halved promotion chances of employees. Similarly to jobs like sales and secretarial assistance, call-

[11] Marital disruption is captured by the transition from a married status to a non-married status for consistency with the variables included in regressions in the other sections of this study.

[12] Schwartz introduced the notion of a more flexible path in organizations, specifically aimed at facilitating both caregiving and career goals of women with children. This path is termed the "mommy track".

center jobs are often considered to have limited promotability, as they typically involve repetitive tasks and more standardized procedures that focus on providing customer service or handling specific inquiries. In this sample, 35.8 percent of women work in sales and clerical occupations.

5.2 INSTRUMENT EXOGENEITY

The first-stage estimates in Table 5 indicate that the temporary child health instrument is relevant and strong. Without over-identification, it is more challenging to provide evidence supporting the exogeneity of the instrument. After having demonstrated that a temporary child health issue does not directly lead to a reduction in working hours or job mobility, which are regarded as the primary concerns for the instrument exogeneity, an additional effort is undertaken to provide further justification for the validity of the instrument.

Table 8: Alternative Reduced Form Estimates – Test 1

	Log of Hourly Wage
A. *1 to 2 Years Before*	.000
Child Health Problem	(.011)
B. *3 to 4 Year Before*	-.014
Child Health Problem	(.011)
Other regressors	Yes
Fixed Effects	Yes

Note: Clustered standard errors at the individual level in parentheses. The number of women is 1,268. The number of woman-year observations is 10,593. Other regressors include indicators for total hours worked on site and at home, age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18 in the household.

The first validity test, presented in Table 8, is a placebo test where a temporary child health problem is "falsely" assigned to be one to two years and three to four years before it actually occurred. The exclusion restriction would be violated if mothers' productivity changed in anticipation of a child health shock. The results of this placebo test reveal no statistically significant impact of the child health problem on mothers' wages prior to its actual occurrence. These findings provide additional support for the validity of

the instrument by indicating that the child health shock is not anticipated.[13, 14]

Table 9 presents the results from the second validity test. This test focuses specifically on a subsample of mothers who have never engaged in remote work. In this subsample, it is not possible to estimate a first-stage regression since there is no variation in remote-work status. However, one can estimate the reduced-form effect of the temporary child health problem on these mothers' wages. Because the child health issue has no effect on remote work in this subsample, effects of confounding factors related to the temporary child health problem should emerge. Confidence in instrument validity is strengthened as there is no significant reduced-form effect of the child health issue on wages.[15]

Table 9: Alternative Reduced Form Estimates - Test 2

	Log of Hourly Wage
Child Health Problem	-.017
	(.014)
$I(1,040 < \text{Total Hours} \leq 1,560)$	.007
	(.020)
$I(1,560 < \text{Total Hours} \leq 2,080)$	.085
	(.019)
$I(\text{Total Hours} > 2,080)$	.075
	(.022)
Professional, Technical	.064
and Managers	(.024)
Sales and Clerical	-.032
	(.022)
Other regressors	Yes
Fixed Effects	Yes

Note: Clustered standard errors at the individual level in parentheses. The number of mothers is 551. The number of mother-year observations is 4,375. Total hours worked is the sum of hours worked on site and at home in a calendar year. Other regressors include age, age squared, an indicator for whether the woman is married, spousal income and the number of children under 18 in the household.

Tables 8 and 9 show that there is limited evidence for the anticipation of a child health shock and existence of unobserved persistent determinants of wages correlated with the child health shock that may drive the substantial wage penalties observed in Table

[13] No precisely estimated coefficients from reduced-form regressions for a reduction in total hours were found.
[14] A temporary child health problem has also been "falsely" assigned to be one to two years and three to four years after it actually occurred. The results of this test reveal no statistically significant impact of the child health problem on mothers' wages after its actual occurrence.
[15] Altonji et al. (2005) and Angrist et al. (2010) present evidence for the exclusion restrictions that justify IV by estimating reduced-form effects in samples with no first stage.

6. These results substantiate the key assumption that the temporary child health problem is non-anticipated and does not have a direct effect on wages but is rather channeled through working from home.

6 CONCLUSION

Using data on women in the NLSY79 and their children in the NLSCYA, this paper estimates the wage effects associated with working at home. There is still no consensus in the literature as to whether a wage premium or a wage penalty to remote work is a more likely outcome. The main contribution of this paper is in the presentation of IV estimates using nationally representative data on women and the health status of their children. The proposed source of exogenous variation in the propensity to work at home is a temporary child health shock. The instrument is shown to be relevant and strong, as well as plausibly exogenous.

The study finds female wage penalties to working at home which are statistically significant and substantial in magnitude. OLS estimates yield a wage penalty of 8.2 percent. FE estimates yield a larger wage penalty of 12.2 percent. IV estimates that include fixed effects and exploit the child health instrument result in a significantly larger wage penalty of 68.9 percent.

The larger negative magnitude of the IV estimate is suggestive of positive selection into working at home. The co-existence of positive selection and a wage penalty, along with the results from alternative first stage-regressions point to pathways that are more likely to underlie the remote-work wage penalty than others. The findings are more consistent with women becoming less productive while working at home, because they are assigned or choose less promotable tasks. Better data would allow for a more precise examination of the distinct influence of remote work on female wages, distinguishing it from other possible sources of female wage penalties related to remote work, such as compensating wage differentials, negative signaling and statistical discrimination.

It is crucial to acknowledge the limitations of the present study, specifically the absence of an examination of the role of race. Taking race into account is important because it intersects with various factors, including access to quality job opportunities and networks, as well as other challenges encountered by women from diverse racial backgrounds in managing both their careers and motherhood.

Remote work is expected to continue being a prevalent practice in the post-pandemic

era, mainly due to the increasing adoption of hybrid office models that allow for greater flexibility. Nevertheless, parents, especially mothers, may still strive to cope with increased childcare responsibilities when their children fall ill and need to stay home. Temporary health issues that require additional care, such as monitoring or medical attention, can exacerbate this situation.

In conclusion, although there has been longstanding attention given to expanding remote work opportunities, the post-pandemic era has emphasized the urgency of tackling the wage penalty that accompanies remote work. The aspirations of women to successfully balance family and career highlight the imperative of addressing issues such as childcare support and fostering a fairer allocation of child-rearing responsibilities.

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