Supplemental Online Appendix

for

Occupational Skill Mismatch: Differences by Gender and Cohort

John T. Addison, Liwen Chen, and Orgul D. Ozturk

Appendix A: Occupational Codes in the NLSY Surveys and Mapping across Different Coding Systems

Until 1981 all occupations and industries in the NLSY79 were coded using 1970 Census codes (Census Occupational Classifications [COCs] and Census Industrial Classifications [CICs], respectively). Beginning with the 1982 survey, occupations were coded using the 1980 Census codes, in addition to the 1970 codes, until 2002. After that year, the 2002 COC was used to code occupations, and subsequent to the 2010 round the 2010 COCs were also provided. For its part, even though the first five rounds of the NLSY97 employed 1990 codes to classify occupations, the 2002 Census codes were added retroactively for all rounds and are also provided for the newer rounds of the survey along with 2010 COCs. Similarly, industries were described by their 3-digit 1980 CIC in the NLSY79 until 2000; thereafter, 4-digit 2002 CICs are used. 2002 CICs are available for all rounds of the NLSY97.

In order to map all occupation codes across survey years, the 2002 Census Occupation Codes (COC) are first converted to 2000 COCs and then mapped to the 3-digit occupation codes (occ1990dd) constructed in Dorn (2009). Specifically, respondents' 2000 COCs were mapped to occ1990dd using the crosswalks downloaded from http://www.ddorn.net/data.htm on September 24, 2015. It emerged that there were 11 occupations not worked by NLSY97 respondents, 21 occupations that could not be mapped to occ1990dd, and 2 occupations that were miscoded. After

Dorn, we assigned the approximate 1990dd code to the 21 un-mapped 2000 COC occupations to minimize observation loss. The list of occupations that were manually mapped is as follows:

2000 COC	Occupation name	Occ1990dd	Occupation name
123	Statisticians	68	Mathematicians and statisticians
134	Biomedical engineers	59	Engineers and other professionals, n.e.c.
383	Fish and game wardens	427	Protective service, n.e.c.
416	Food preparation and serving-related workers, all other	444	Miscellaneous food preparation and service workers
631	Pile-driver operators	599	Misc. construction and related occupations
521	Correspondence clerks	326	Correspondence and order clerks
650	Reinforcing Iron and Rebar Workers	597	Structural metal workers
705	Electrical and Electronics Installers and Repairers, Transportation Equipment	533	Repairers of electrical equipment, n.e.c.
802	Milling and Planning Machine Setters, Operators, and Tenders, Metal and Plastic	703	Lathe, milling, and turning machine operatives
812	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	684	Other precision and craft workers
884	Semiconductor Processors	779	Machine operators, n.e.c.
911	Ambulance Drivers and Attendants, except Emergency Medical Technicians	809	Taxi cab drivers and chauffeurs
950	Conveyor Operators and Tenders	889	Laborers, freight, stock, and material handlers, n.e.c
150	Mining and Geological Engineers, including Mining Safety Engineers	59	Petroleum, mining, and geological engineers
194	Nuclear Technicians	235	Other science technicians
602	Animal breeders	479	Animal Breeders; Animal caretakers, except farm
692	Roustabouts, oil and gas	616	Miners
693	Helpers--extraction workers	617	Other mining occupations
752	Commercial drivers	809	Taxi cab drivers and chauffeurs
973	Shuttle car operators	808	Bus drivers
974	Tank car, truck, and ship loaders	859	Stevedores and misc. material moving occupations
467	Not in 2000 COC	No Code	N/A
617	Not in 2000 COC	No Code	N/A

Note: n.e.c., not elsewhere classified.

After mapping, the occupations are divided into six aggregate groups, using the do-files downloaded from the same Dorn website. The six groups, which are also used by Autor and Dorn (2013), are as follows: managerial and professional specialty; technical, sales, and administrative support; services; farming, forestry, and fishing; precision production, craft, and repair; and operators, fabricators, and laborers. There are 14 industry and sector groups. All public employees are assigned a single public administration/public sector dummy. The remaining 13 (private) industry/sector groups are agriculture, forestry, and fisheries; mining; construction; manufacturing (non-durable goods); manufacturing (durable goods); transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance, and real estate; business and repair services; personal services; entertainment and recreation services; and professional and related services.

Appendix B: The Mapping of ASVAB and O*NET Components

There are 10 ASVAB subtests (the 1997 version [CAT-ASVAB] has 12). Seven among these are grouped into three composites: verbal, math, and science and mechanical.[1] We follow DoD guidelines in mapping ASVAB subtests to these composites and then to O*NET occupational knowledge, skill, and ability components (KSAs). There are 110 KSAs—knowledge (sets of facts and principles needed to address problems and issues that are part of a job), skills (the ability to perform a task well), and abilities (enduring talent that can help a person do a job)—subsets of which are required to perform successfully in each occupation. For each of the occupations in the O*NET database, either expert job analysts, job supervisors, or job incumbents rate the degree of importance of each of the KSAs and the degree of proficiency needed in each for satisfactory performance in that particular occupation (ASVAB Technical Chapter accessed at https://www.asvabprogram.com/pdf/ASVAB_CEP_Technical_Chapter.pdf). KSAs capture what workers in an occupation are expected to do, not what current workers in an occupation are doing or are capable of doing, although they are highly indicative of these average worker characteristics. In this way, KSAs are analogous to the item content of a test, as both perform the same function of operationalizing the domain in question. Therefore, linking ASVAB test content and scores with O*NET occupational requirements is a natural next step and is achieved through an analysis of the relationship between ASVAB subtests and the KSAs that best describe particular occupations. For

[1] *Shop Information, Auto Information,* and *Assembling Objects* are not used for 1979 and in addition to these *Coding Speed* and *Numerical Operations* are not employed in 1997.

this purpose, as a first stage, two experts identify 26 of the 110 KSAs from O*NET as possibly related to the ASVAB Verbal, Math, and Science and Mechanical/Technical Composites. Next, a larger group of expert judges (9 for verbal and math and 14 for STM), comprising industrial/organizational psychologists, other types of psychologists, and psychometricians, score the relatability of each of these 26 individual KSAs and particular ASVAB subtest. A high correlation across judges' scores is required to establish the links. The linkage shown below is drawn up in light of this factor analysis:

ASVAB component	O*NET Knowledge/Skill/Ability	O*NET component
Verbal		
Word knowledge	Ability	Inductive reasoning
Paragraph comprehension	Ability	Written comprehension
	Ability	Oral comprehension
	Knowledge	English language
	Skill	Reading comprehension
Math		
Arithmetic reasoning	Ability	Deductive reasoning
Math knowledge	Ability	Inductive reasoning
	Ability	Written comprehension
	Ability	Number facility
	Ability	Mathematical reasoning
	Ability	Information ordering
	Knowledge	Mathematics
	Skill	Science
	Skill	Mathematics
Science and Mechanical		
General science	Ability	Deductive reasoning
Mechanical comprehension	Ability	Inductive reasoning
Electronics information	Ability	Written comprehension
	Knowledge	Mechanical
	Knowledge	Biology
	Knowledge	Computers and electronics
	Knowledge	Engineering and technology
	Knowledge	Chemistry
	Knowledge	Physics
	Knowledge	Building and construction
	Skill	Technology design
	Skill	Science
	Skill	Installation
	Skill	Troubleshooting
	Skill	Equipment selection

More information on knowledge, skill, and abilities can be found at https://www.onet center.org/dictionary/22.3/excel/. More information on ASVAB subtests can be found at https://www.bls.gov/nls/nlsasv79.htm, and a sample ASVAB score card can be found at https://www.nlsinfo.org/sites/nlsinfo.org/files/attachments/170816/ASVAB Score Report Sample.pdf.

Appendix C: Instrumental Variables for Fertility Timing

Siblings' Average Age at the First Birth

In the light of the possible endogeneity between occupational match quality and an individual's fertility timing, Table 9 in the article text instruments individuals' relative/absolute ages at first birth using their siblings' average age at the birth of their first child. The first stage results for IV-1 estimations are presented in Table C.1. As can be seen, individuals' fertility time is strongly correlated with their siblings' fertility time. A one-year increase in siblings' average birth age will result in a 0.15 to 0.2-year (about 2 to 2.5 months) increase in an individual's absolute/relative age at first birth.

The table also reports the tests of relevance and validity of the instrument. Test statistics indicate that the age at first birth variables are endogenous for females only, and our instrument is significantly and positively correlated with our endogenous variable.

Table C.1. First Stage Regression for Siblings' Average Age at First Birth as Instrument

	Male		Female	
	Absolute age	Relative age	Absolute age	Relative age
Siblings' average age at first birth	0.2272	0.2264	0.1629	0.1497
	[0.0401]**	[0.0409]**	[0.0437]**	[0.0480]**
Control for demographic variables	Yes	Yes	Yes	Yes
Control for tenure and experience variables	Yes	Yes	Yes	Yes
R-squared	0.31	0.28	0.33	0.31
Tests of endogeneity of birth-age or relative birth-age				
Durbin-Wu-Hausman chi-sq test (*p*-value)	0.51	0.58	0.03	0.03
Underidentification test (Kleibergen-Paap rk *LM* statistic):	29.61	28.25	13.44	9.65
Weak identification test (Cragg-Donald Wald *F* statistic):	437.83	401.93	187.98	126.12

Notes: This table presents the first stage results and the relevant IV validity tests for the IV-1 estimations in Table 9. The dependent variables are individuals' relative/absolute ages at first birth.
** denotes significance at 0.01 level.

An Alternative Instrumental Variable: Miscarriage at the First Pregnancy

Our second instrument is an unconventional one. The literature on the wage penalty of motherhood instruments fertility timing in other ways for females. We will test the robustness of our results to choice of instrument using miscarriage at the first pregnancy to instrument the age at first birth after Miller (2011). As the NLSY79 data contain information only about a woman's first pregnancy outcome, we conduct the estimations for females alone. In constructing an instrument for the age of first birth of women whose first pregnancy ended in an abortion we use the timing of the first non-aborted pregnancy.[2] The first stage regression results are presented in Table C.2. As shown in the table, the experience of a miscarriage at the first pregnancy leads to a two-year fertility delay. This instrument is both relevant and valid as indicated by the tests statistics reported below.

[2] Following Miller (2011), we used questions on pregnancy losses from multiple interview rounds of the NLSY79—the first round asked about the first pregnancy and subsequent rounds about pregnancies since the last interview—to fill in if there was a miscarriage at the first non-aborted pregnancy for women whose first pregnancy ended in abortion.

Table C.2. First Stage Results for the Alternative Instrumental Variable: Miscarriage at the First Pregnancy

	Female	
	Absolute birth age	Relative birth age
Miscarriage at the first pregnancy	1.991 [0.153]**	2.0933 [0.175]**
Control for demographic variables	Yes	Yes
Control for tenure and experience variables	Yes	Yes
R-squared	0.33	0.32
Underidentification test (Kleibergen-Paap rk *LM* statistic):	150.02	129.847
Weak identification test (Cragg-Donald Wald *F* statistic):	175.24	153.18

Note: See notes of Table C.1.

The second stage regression results using this alternative instrument are presented in Table C.3. Consistent with our results in the main body of the text, a one-year delay in the fertility time significantly reduces the amount of mismatch by about 6% of a standard deviation.

Table C.3. Second Stage Results for the Alternative Instrumental Variable: Miscarriage at the First Pregnancy

Measure of age at first birth	IV-1	IV-2
Relative age at the first birth	–0.0632 [0.0157]**	–0.0639 [0.0151]**
Absolute age at the first birth	–0.0665 [0.0164]**	–0.0674 [0.0159]**

Notes: The dependent variable is the rescaled total amount of mismatch. See notes to Table C.1 and Table 9.

Appendix D: The Numbers behind the Figures

Flexibility and Mismatch

Table D.1. Mismatch, Fertility Timeline, and Occupation Flexibility (NLSY79)

	Male	Female
Flexibility score	–0.0365	–0.0236
	[0.0233]	[0.0244]
More than 3 years before the first birth	0.0444	0.030
	[0.0322]	[0.0425]
0–6 years after the first birth	–0.0411	0.0918
	[0.0258]	[0.0389]*
More than 6 years after the first birth	0.0056	0.178
	[0.0370]	[0.0490]**
More than 3 years before the first birth * Flexibility score	0.0355	–0.0104
	[0.0322]	[0.0382]
0–6 years after the first birth * Flexibility score	0.0415	0.0282
	[0.0283]	[0.0351]
More than 6 years after the first birth * Flexibility score	0.0456	0.0766
	[0.0320]	[0.0336]*
Observations	23,261	18,761

Notes: See notes to Table 10.

Table D.1 is the basis of our Figure 2. The last column of the table indicates that working in flexible occupations leads to a greater amount of mismatch for females after the first birth. Notice that in the last column, the coefficient for *More than 3 years before the first birth * Flexibility score* is negative but statistically insignificant, suggesting that long before females' first birth, working in flexible occupations does not yield greater mismatch. However, the effect becomes positive after the birth of the first child, and in the case of *More than 6 years after the first birth* the flexibility interaction coefficient is positive and statistically significant. This finding means that mothers working in flexible occupations have much worse match quality compared with their childless counterparts more than six years following the birth of their first child—a 1 standard deviation increase in flexibility increases mismatch by approximately 8% of a standard deviation. This implies that mothers are trading off match quality for enhanced flexibility at work, an effect that becomes stronger as their children grow up. No such effects are observed for males.

Mismatch and the Gender Pay Gap

Table D.2 is the basis of our Figure 3. This table outlines the gender gap in the wage loss from mismatch (relative to the mean wage) for individuals with different levels of early match quality. We selected individuals in the sample based on their early match quality (i.e., an individual's match quality over the first five years of experience), distinguishing between the best and the worst occupational matches—respectively, the top 10% and the bottom 10% in terms of match quality—among both college graduates and non-graduates.

To illustrate the results given in this table, we provide the basis of the calculation for college graduates with 10 years of labor market experience. To simplify matters, we shall assume that total experience equals occupational tenure for everyone. Further, only the precisely estimated mismatch coefficients from column (4) of Table 11 will be used. As there are no statistically significant gender differences in mismatch wage penalties, we base our calculation of mismatch and the gender wage gap on the following wage penalty coefficients: Current mismatch = –0.0311 (*Mismatch * College and above*); Cumulative Mismatch = –0.0934 (*Cumulative mismatch + Cumulative mismatch * College and above)*. Current and past mismatch values are averages for these groups from data at the point of calculation. For example, for college graduates with the best early match quality, the average current mismatch is 1.29 for males and 2.14 for females at 10 years of experience. The average cumulative mismatch is 1.53 for males and 1.87 for females at 10 years of experience. Based on these values, we can compute the wage loss (relative to the mean wage) from each mismatch component. Thus, in the case of males, the wage effect of current mismatch is –0.04 (= –0.0311*1.29) and for cumulative mismatch it is –0.14 (= –0.0934*1.53). The corresponding wage losses for females are –0.07 (= –0.0311*2.14) and –0.17 (= –

0.0934*1.87), respectively. The gender gap in wage loss associated with current mismatch—namely, the wage loss for females less the wage loss for males—is thus –0.032 (column (9) of Table D.2) and that associated with cumulative mismatch is also –0.026 (column (10)). The total gender gap in wage loss associated with mismatch is –0.058.

Column (11) of Table D.2 presents a calculation of the gender gap in the wage loss from mismatch, using both the statistically insignificant and significant coefficients. We now base our calculations on the following wage penalty coefficients. Beginning with males: Current mismatch = –0.0262 (= 0.0049 + –0.0311) (*Mismatch + Mismatch * College and above*); Cumulative Mismatch = –0.0934 (= –0.0421 + –0.0513) (*Cumulative mismatch + Cumulative mismatch * College and above);* Current mismatch and occupational tenure interaction = 0.0005 (= –0.0009 + 0.0014) (*Mismatch * Occupation tenure + Mismatch * Occupation tenure * College and above*). For females: Current mismatch = –0.0371 (= 0.0049 + 0.0063 + –0.0311 + –0.0172) (*Mismatch + Mismatch * Female + Mismatch * College and above + Mismatch * College and above * Female*); Cumulative Mismatch = –0.0871 (= –0.0421 + –0.0052 + –0.0513 + 0.0115) (*Cumulative mismatch + Cumulative mismatch * Female + Cumulative mismatch * College and above + Cumulative mismatch * College and above * Female);* Current mismatch and occupational tenure interaction = –0.0016 (= –0.0009 + –0.0013 + 0.0014 + –0.0008) (*Mismatch * Occupation tenure + Mismatch * Occupation tenure * Female + Mismatch * Occupation tenure * College and above + Mismatch * Occupation tenure * College and above * Female*). On this basis, the gender wage gap from current mismatch is equal to –0.045 (= –0.0371*2.14 + 0.0262*1.29), from current mismatch and occupational tenure interaction it is equal to –0.0407 (= –0.0016*10*2.14 – 0.0005*10*1.29), and from cumulative mismatch it is –0.0199 (= –0.0871 *1.87 + 0.0934*1.53). The total gender wage gap attributable to mismatch is therefore –0.106.

In similar fashion, we can calculate wage losses for college graduates with the worst early match quality. The total gender gap in wage loss associated with mismatch is 0.006 using only the precisely estimated coefficients, and –0.037 using both significant and insignificant ones.

Table D.2. Mismatch and the Gender Wage Gap, by Experience, Early Match Quality, and Education

		Male				Female				Gender Gap			
				Wage Effect				Wage Effect					
		Cumulative mismatch	Current mismatch	Cumulative mismatch	Current mismatch	Cumulative mismatch	Current mismatch	Cumulative mismatch	Current mismatch	Cumulative mismatch	Current mismatch	Total (significant and insignificant coefficients)	Total (significant coefficients only)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
College Graduates													
Experience and Early match quality	10 Year Exp.												
	Best	1.53	1.29	-0.14	-0.04	1.87	2.14	-0.17	-0.07	-0.032	-0.026	-0.106	-0.058
	Worst	3.71	2.05	-0.35	-0.06	3.65	2.05	-0.34	-0.06	0.006	0.000	-0.037	0.006
	20 Year Exp.												
	Best	1.8	1.31	-0.17	-0.04	2.36	2.01	-0.22	-0.06	-0.052	-0.022	-0.155	-0.074
	Worst	3.41	1.94	-0.32	-0.06	3.57	1.83	-0.33	-0.06	-0.015	0.003	-0.087	-0.012
	30 Year Exp.												
	Best	1.92	1.12	-0.18	-0.03	2.56	1.56	-0.24	-0.05	-0.060	-0.014	-0.164	-0.073
	Worst	3.37	1.84	-0.31	-0.06	3.57	2.11	-0.33	-0.07	-0.019	-0.008	-0.155	-0.027
Non-College Graduates													
Experience and Early match quality	10 Year Exp.												
	Best	1.56	1.43	-0.07	0.01	1.6	1.59	-0.07	0.01	-0.002	0.000	-0.021	-0.002
	Worst	3.96	2.53	-0.17	0.01	3.98	2.91	-0.17	0.01	-0.001	0.000	-0.043	-0.001
	20 Year Exp.												
	Best	2.01	1.68	-0.08	0.01	2.07	1.76	-0.09	0.01	-0.003	0.000	-0.049	-0.003
	Worst	4.08	2.38	-0.17	0.01	4.13	2.54	-0.17	0.01	-0.002	0.000	-0.076	-0.002
	30 Year Exp.												
	Best	2.17	1.43	-0.09	0.01	2.23	1.56	-0.09	0.01	-0.003	0.000	-0.068	-0.003
	Worst	4.11	2.32	-0.17	0.01	4.17	2.52	-0.18	0.01	-0.003	0.000	-0.111	-0.003

Notes: Early match quality is determined according to an individual's match quality over the first 5 years of experience. In this table we have the top decile (Best) and the bottom decile (Worst) early career matches. Current and past mismatch values are averages for these groups from data at the point of calculation. In column (12) we consider wage effects of mismatch using only the precisely estimated mismatch coefficients; for example, excluding the coefficient of the interaction between mismatch and occupation tenure. Column (11) computes wages effects using both precisely and imprecisely estimated coefficient estimates.

Table D.3. Motherhood Wage Penalty

	Current Mismatch			Cumulative Mismatch			Mismatch Wage Effect (Significant only)			Mismatch Wage Effect (Significant and insignificant)			Wage Gap (Significant coefficients only)		Wage Gap (Significant and insignificant)	
Age	Birth Age=25	Birth Age=30	No Child	Birth Age=25	Birth Age=30	No Child	Birth Age=25	Birth Age=30	No Child	Birth Age=25	Birth Age=30	No Child	Birth Age=25	Birth Age=30	Birth Age=25	Birth Age=30
College Graduates																
24	**2.46**	1.72	2.52	**2.59**	2.54	2.65	**-0.23**	-0.20	-0.24	**-0.28**	-0.25	-0.29	**0.01**	0.04	**0.01**	0.04
25	**2.16**	1.70	2.01	**2.64**	2.58	2.68	**-0.21**	-0.19	-0.21	**-0.27**	-0.25	-0.27	**0.00**	0.02	**0.00**	0.02
26	**2.84**	1.97	1.88	**3.10**	2.59	2.65	**-0.25**	-0.20	-0.20	**-0.32**	-0.26	-0.26	**-0.06**	0.00	**-0.07**	0.00
27	**2.83**	1.97	2.01	**3.13**	2.60	2.70	**-0.25**	-0.19	-0.20	**-0.32**	-0.25	-0.26	**-0.05**	0.01	**-0.06**	0.01
28	**2.99**	1.98	2.08	**3.19**	2.63	2.77	**-0.25**	-0.19	-0.20	**-0.32**	-0.25	-0.26	**-0.05**	0.01	**-0.06**	0.01
29	**2.39**	**1.95**	2.06	**3.23**	**2.69**	2.81	**-0.23**	**-0.19**	-0.20	**-0.30**	**-0.25**	-0.26	**-0.03**	**0.01**	**-0.04**	**0.01**
30	**2.58**	**2.09**	1.83	**3.27**	**2.72**	2.78	**-0.22**	**-0.19**	-0.18	**-0.31**	**-0.25**	-0.25	**-0.04**	**0.00**	**-0.06**	**0.00**
31	2.72	**2.00**	1.75	3.40	**2.60**	2.72	-0.23	**-0.17**	-0.17	-0.32	**-0.24**	-0.24	-0.05	**0.00**	-0.07	**0.00**
32	2.58	**2.00**	1.63	3.43	**2.95**	2.81	-0.22	**-0.18**	-0.17	-0.31	**-0.26**	-0.24	-0.05	**-0.01**	-0.07	**-0.02**
33	2.40	**2.32**	1.73	3.47	**2.81**	2.81	-0.21	**-0.18**	-0.17	-0.30	**-0.26**	-0.24	-0.04	**-0.01**	-0.06	**-0.01**
34	2.42	**2.22**	1.97	3.52	**2.81**	2.94	-0.21	**-0.17**	-0.17	-0.30	**-0.25**	-0.25	-0.03	**0.00**	-0.05	**0.00**
35	2.61	**2.22**	1.91	3.60	**3.03**	3.01	-0.20	**-0.17**	-0.17	-0.31	**-0.26**	-0.25	-0.04	**0.00**	-0.06	**-0.01**
Non-College Graduates																
24	**1.99**	1.92	2.10	**2.06**	2.40	2.24	**-0.10**	-0.12	-0.11	**-0.10**	-0.12	-0.11	**0.01**	-0.01	**0.01**	-0.01
25	**2.01**	1.68	2.05	**2.11**	2.44	2.37	**-0.11**	-0.12	-0.12	**-0.10**	-0.12	-0.12	**0.01**	0.00	**0.01**	0.00
26	**2.39**	1.87	2.00	**2.52**	2.50	2.42	**-0.13**	-0.13	-0.12	**-0.13**	-0.13	-0.12	**-0.01**	0.00	**-0.01**	0.00
27	**2.53**	1.75	2.00	**2.71**	2.51	2.49	**-0.14**	-0.13	-0.13	**-0.14**	-0.13	-0.13	**-0.01**	0.00	**-0.01**	0.00
28	**2.14**	1.81	2.02	**2.71**	2.65	2.58	**-0.14**	-0.13	-0.13	**-0.14**	-0.14	-0.14	**-0.01**	0.00	**-0.01**	0.00
29	**2.14**	**1.84**	2.02	**2.72**	**2.69**	2.61	**-0.14**	**-0.14**	-0.13	**-0.15**	**-0.14**	-0.14	**-0.01**	**0.00**	**-0.01**	**0.00**
30	**2.24**	**1.91**	1.92	**2.83**	**2.72**	2.63	**-0.14**	**-0.14**	-0.13	**-0.15**	**-0.15**	-0.14	**-0.01**	**0.00**	**-0.01**	**0.00**
31	2.14	**1.88**	1.97	2.87	**2.73**	2.66	-0.15	**-0.14**	-0.14	-0.16	**-0.15**	-0.15	-0.01	**0.00**	-0.01	**0.00**
32	2.43	**2.00**	1.86	3.02	**2.85**	2.67	-0.15	**-0.15**	-0.14	-0.17	**-0.16**	-0.15	-0.02	**-0.01**	-0.02	**-0.01**
33	2.32	**2.23**	1.82	3.06	**2.78**	2.67	-0.16	**-0.14**	-0.14	-0.17	**-0.16**	-0.15	-0.02	**-0.01**	-0.02	**-0.01**
34	2.35	**2.00**	1.90	3.32	**2.69**	2.71	-0.17	**-0.14**	-0.14	-0.19	**-0.16**	-0.16	-0.03	**0.00**	-0.04	**0.00**
35	2.63	**2.46**	1.93	3.34	**2.93**	2.89	-0.17	**-0.15**	-0.15	-0.20	**-0.18**	-0.17	-0.02	**0.00**	-0.03	**-0.01**

Mismatch, Age at First Birth, and the Motherhood Wage Penalty

Table D.3 is the basis of Figure 4. This table provides the differences in wage loss associated with mismatch for females who gave birth to their first child either at age 25 or age 30 vis-à-vis their childless counterparts.

To illustrate the results given in this table, we provide the basis of the calculation for college graduates entering the labor market at age 23. Again, we first consider the effects for precisely estimated mismatch coefficients shown in the final column of Table 11: *Cumulative mismatch* (–0.0509), *Mismatch * College and above* (–0.0429), and *Mismatch * Occupation tenure * College and above* (0.0029). Current and cumulative mismatch values are averages for these groups from data at the point of calculation. For example, at the age of 30 (or five years after the first birth for those who had a child at 25), the current mismatch is 1.83 for those without a child, 2.58 for those whose first birth age is 25, and 2.09 for those whose first birth age is 30; the cumulative mismatch is 2.78 for those without a child, 3.27 for mothers whose first birth age is 25, and 2.72 for mothers whose first birth age is 30. Based on these values, we can compute the wage loss (relative to the mean wage) due to each mismatch component.

The wage effect of current mismatch is –0.0785 (= –0.0429*1.83) for those without a child, –0.111 (= –0.0429*2.58) for mothers whose first birth age is 25, and –0.090 (= –0.0429*2.09) for mothers whose first birth age is 30. The wage effect of cumulative mismatch is –0.142 (= –0.0509*2.78) for those without a child, –0.166 (= –0.0509*3.27) for mothers whose first birth age is 25, and –0.138 (= –0.0509*2.72) for mothers whose first birth age is 30. With respect to occupational tenure, by the age of 30 all groups will have seven years of occupational tenure (here, for purposes of illustration we are imposing the restriction that they are employed in the same occupation). For its part, the wage effect from the interaction of current mismatch and occupational tenure among college graduates is 0.037 (= 0.0029*1.83*7) for those without a child, 0.052 (= 0.0029*2.58*7) for mothers whose first birth age is 25, and 0.042 (= 0.0029*2.09*7) for mothers whose first birth age is 30. At the age of 30, the differences in wage loss associated with mismatch between mothers whose first birth age is 25 and their childless counterparts is –0.042 [= (–0.0429*2.58+–0.0509*3.27+0.0029*2.58*7) – (–0.0429*1.83+–0.0509*2.78+0.0029*1.83*7)]. Similarly, the differences in wage loss associated with mismatch, between mothers-to-be whose first birth age is 30 and their childless counterparts at the same age is 0.002 [= (–0.0429*2.09+–0.0509*2.72+0.0029*2.09*7) – (–0.0429*1.83+–0.0509*2.78+0.0029*1.83*7)].

Figure 4 in the article text graphs these losses over the timeline of first birth (comparing the highlighted portions of the penultimate set of two columns). Comparing the two groups of mothers (with first birth age at 25 and 30) five years after the first birth will require us to compare their wage losses at ages 30 and 35, respectively. The gap for mothers who gave first birth at age 25, relative to their childless counterparts, was earlier calculated to be –0.042. This gap is 0 for mothers who gave first birth at age 30 relative to their childless counterparts at age 35. This implies more than 4 percentage points higher wage loss due to mismatch for individuals with earlier births, five years after birth. Figure 4 captures only the gaps calculated using the precisely estimated coefficients. The last two columns of Table D.3 provide the corresponding gaps calculated using all relevant coefficients (significant and nonsignificant)

Appendix E. Marginal Effects for Table 12 in Article Text

Table E.1. Pairwise Comparisons of Predictive Margins

Comparison groups	Difference in predicted probabilities	Std Err.	95% Confidence Interval	
Non-college graduate NLSY79 female vs non-college graduate NLSY79 male	-0.0138	0.0035	-0.0205	-0.007
College graduate NLSY79 male vs non-college graduate NLSY79 male	-0.0183	0.0050	-0.0280	-0.0086
College graduate NLSY79 female vs non-college graduate NLSY79 male	-0.0244	0.0054	-0.0351	-0.0137
Non-college graduate NLSY97 male vs non-college graduate NLSY79 male	0.0139	0.0044	0.0052	0.0226
Non-college graduate NLSY97 female vs non-college graduate NLSY79 male	-0.0107	0.0047	-0.0200	-0.0015
College graduate NLSY97 male vs non-college graduate NLSY79 male	0.0171	0.0064	0.0046	0.0297
College graduate NLSY97 female vs non-college graduate NLSY79 male	0.0102	0.0061	-0.0018	0.0222
College graduate NLSY79 male vs non-college graduate NLSY79 female	-0.0045	0.0054	-0.0151	0.0061
College graduate NLSY79 female vs non-college graduate NLSY79 female	-0.0106	0.0058	-0.0221	0.0008
Non-college graduate NLSY97 male vs non-college graduate NLSY79 female	0.0277	0.0048	0.0183	0.037
Non-college graduate NLSY97 female vs non-college graduate NLSY79 female	0.0030	0.0050	-0.0068	0.0128
College graduate NLSY97 male vs non-college graduate NLSY79 female	0.0309	0.0068	0.0176	0.0442
College graduate NLSY97 female vs non-college graduate NLSY79 female	0.0239	0.0065	0.0112	0.0367
College graduate NLSY79 female vs college graduate NLSY79 male	-0.0061	0.0059	-0.0176	0.0055
Non-college graduate NLSY97 male vs college graduate NLSY79 male	0.0322	0.0059	0.0206	0.0439
Non-college graduate NLSY97 female vs college graduate NLSY79 male	0.0076	0.0062	-0.0046	0.0197
College graduate NLSY97 male vs college graduate NLSY79 male	0.0354	0.0070	0.0218	0.0491
College graduate NLSY97 female vs college graduate NLSY79 male	0.0285	0.0067	0.0154	0.0416
Non-college graduate NLSY97 male vs college graduate NLSY79 female	0.0383	0.0060	0.0266	0.05
Non-college graduate NLSY97 female vs college graduate NLSY79 female	0.0136	0.0063	0.0013	0.0259
College graduate NLSY97 male vs college graduate NLSY79 female	0.0415	0.0071	0.0276	0.0554
College graduate NLSY97 female vs college graduate NLSY79 female	0.0346	0.0068	0.0213	0.0478
Non-college graduate NLSY97 female vs non-college graduate NLSY97 male	-0.0247	0.0042	-0.0330	-0.0163
College graduate NLSY97 male vs non-college graduate NLSY97 male	0.0032	0.0060	-0.0086	0.015
College graduate NLSY97 female vs non-college graduate NLSY97 male	-0.0037	0.0057	-0.0148	0.0073
College graduate NLSY97 male vs non-college graduate NLSY97 female	0.0279	0.0063	0.0155	0.0403
College graduate NLSY97 female vs non-college graduate NLSY97 female	0.0209	0.0060	0.0091	0.0327
College graduate NLSY97 female vs college graduate NLSY97 male	-0.0070	0.0066	-0.0200	0.006

Notes: These differences in predicted probabilities are generated using Table 12 IV-Probit results. Stata 15 *margins* command is used with *pwcompare* option calculated at specified values of education category, cohort and gender. Significant differences are shaded.

References

Autor, David H., and David Dorn. 2013. The growth of low skill service jobs and the polarization of the U.S. labor market. *American Economic Review* 103(5): 1553–97.

Dorn, David. 2009. Essays on inequality, spatial interaction, and the demand for skills. Dissertation No. 3613. University of St. Gallen, Switzerland.

Miller, Amalia. 2011. The effects of motherhood timing on career path. *Journal of Population Economics* 24(3): 1071–1100.