Human Capital, Self Insurance and Marriage Uncertainty: Racial Difference in the Child Penalty*

Jiaqi Li
University of Warwick †
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Abstract

This paper documents that Black women experience only half the child penalties as white women. The racial gap is driven by married Black women with high wages in the South returning to the labor market almost immediately after childbirth. The racial gap remains after controlling for the racial difference in the distribution of the covariates, such as her characteristics (wage, occupation, industry, or government job), husband covariates (labor income, wage, or gender attitudes), and informal help (household structure, relatives nearby or the number of sisters). Finally, I build a life cycle model of female labor supply, consumption, and savings with uncertainty in divorce shock. Only using the racial difference in marriage and divorce rates, the model is able to generate the same racial gap in child penalties as empirical estimates. The structural model illustrates that Black women stay in the labor market to prevent human capital from depreciation as a means to self-insure against future divorce shocks.

Keywords: Race, Child Penalty, Labor Supply, Household Formation, Divorce

JEL: J13, J15, J16, J22

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†Department of Economics, University of Warwick. Email: j.li.51@warwick.ac.uk
1 Introduction

Mothers experience a substantial reduction in labor market income after childbirth, while fathers remain unaffected. This “child penalty” on women accounts for two-thirds of the overall gender earnings gap in the US (Cortés and Pan, 2020). Kleven et al. (2019b, 2020, 2021) find that comparative advantage, biology, or parental leave policies cannot explain the child penalty. Instead, the recent literature considers preferences, gender norms, and labor market discrimination as lead candidates (Andresen and Nix, 2022; Cortés and Pan, 2020; Kleven, 2023; Kleven et al., 2021).

Despite norms and discrimination being potential mechanisms, it is surprising that little is known about the racial difference in child penalties. First, racial discrimination is substantial in the US labor market (Bertrand and Mullainathan, 2004; Kline et al., 2022). Second, Scarborough et al. (2021) find that Black households have more progressive gender attitudes than white counterparts, potentially due to slavery (Davis, 1981) or discrimination in masculinity identity construction (Bederman, 1995).

In the female labor supply literature, it is also a puzzle that Black women had a higher labor force participation than white women. The striking racial difference in female labor supply remains after controlling for environmental, economic, and family variables (Goldin, 1977) or other economic and demographic observables (Boustan and Collins, 2014), leaving gender norms as the potential explanation.

This paper first documents substantial differences in the child penalties between black and white women in the US using both the Panel Study of Income Dynamics (PSID). Black women have a significantly smaller child penalty in labor earnings than white women. The racial gap in child penalty is driven by all margins, including employment, annual hours worked, and wage rate.

Furthermore, four main descriptive findings are presented. First, this paper rules out single parenthood as the main explanation. The racial gap in child penalties is driven by married women, while there is no racial gap in child penalties among single women.
Second, the racial gap only exists among women in the South, while Black and white women have similar child penalties in other regions. Furthermore, the racial gap is driven by women whose wage is higher than the female median wage, whereas there is no significant racial difference among women with lower wages.

Third, this paper rules out homeownership and family composition as the explanation. The racial gap remains substantial even when we restrict the sample of black and white women who own the place they live (homeownership) or live in a household with no other family members except their husband and children (family structure). The results demonstrate that the racial gap in child penalties is not driven by the need for work to pay rent or mortgage or informal help from other family members living in the same household or nearby.

Of course, Black and white women have very different economic and demographic situations. Therefore, I use inverse probability weighting (IPW) methods to reweight the sample so that Black and white women have a nearly identical distribution of covariates. IPW covariates include the wife’s prior childbirth characteristics, such as education, wage, occupation, industry, working as a government worker, having a job paying for life insurance, and her year of schooling. I also control for the racial differences in the distribution of husband characteristics, such as annual labor income (simultaneous control for husband employment status), hourly wage, and husband’s attitude against wife working.

Contemporaneous covariates cannot explain the racial gap. Can expectations over divorce shocks in the future explain the racial difference in female labor supply following childbirth? This is a reasonable hypothesis given the substantially lower marriage rate among Black women.

To investigate if the racial gap in child penalty is driven by the dynamic process, I establish a life cycle model of discrete choices in employment for women with race-specific marriage and divorce shock (empirically calibrated from PSID). An important feature of the model is that female human capital will accumulate on the job while depreciating otherwise. The structural model can produce the same racial gap in child penalties while the only racial
difference in the model is divorce rates, while parameters in preferences, childcare costs, and discounting factors are identical.

There are four contributions to this paper. First, it documents the substantial racial difference in the child penalty, a new finding in the child penalty literature. Second, it is the first paper to investigate what drives the racial gap in child penalties systemically, and it rules out many previously untested hypotheses proposed in economics and sociology literature, including single parenthood, homeownership, family structure, and gender norms.

The third and most important contribution of the paper is that using a structural model, this paper demonstrates that the racial gap in child penalties is driven by Black women’s concern over future marriage shocks. Staying in the labor market to prevent human capital from depreciation serves as a means to self-insure against future shock.

The fourth contribution is methodological. Using Monte Carlo simulation, I show that child penalty estimates do not converge to the true parameter unless individual fixed effects are used. This is because estimates without individual fixed effects are biased if the age of the first childbirth is endogenous. This is true in PSID as women with lower wages, education, and labor income have childbirth significantly earlier than others. To the best of my knowledge, this paper is the first to propose having an individual fixed effect in the estimation to isolate the sorting effect.

The structure of the paper is as follows. Section 2 documents related literature. Section 3 explains methods and data. Section 4 presents the main results in event study decomposition, heterogeneity, and estimates using IPW controlling for the distribution of covariates. Section 5 establishes a life cycle model of employment, consumption, and savings to demonstrate how the racial gap in marriage shocks can produce the same patterns as empirical child penalty estimates. Finally, Section 6 concludes.
2 Related Literature

2.1 Child penalty

Parenthood has long been considered a major cause of gender inequality in the labor market. Influential work by Kleven et al. (2019a,b) uses event-study analysis to show how immediately and substantially the earnings diverge between men and women after first childbirth and how persistent the gender earning gap has remained ever since.

The magnitude of child penalties is similar between biological and adoptive mothers in Denmark (Kleven et al., 2021) and Norway (Andresen and Nix, 2022). Andresen and Nix (2022) further show that the child penalty is no longer significant between birth-mother and co-mother for same-sex couples and rule out comparative advantage as the primary explanation. Furthermore, substantial expansions of parental leave policies and child care subsidies have not affected the child penalty in Austria for over 60 years (Kleven et al., 2021)

Gender norms, preferences, and labor market discrimination are key candidates to explain the child penalty (Andresen and Nix, 2022; Cortés and Pan, 2020; Kleven, 2023; Kleven et al., 2019a,b). However, to the best of my knowledge, economic research has not explored the racial perspective on the child penalty. The exception is Kleven (2023), with a brief analysis of the racial comparison of the child penalties.

2.2 Racial difference in female labor supply

To the best of my knowledge, the racial perspective on the child penalty has not been explored in economic research. The except is Kleven (2023) with a brief analysis of racial comparison in child penalty with the hypothesis that single parenthood or gender norms may explain the racial gap.

Similarly, in sociology, Waldfogel (1997) and Glauber (2007) point out that black women do not have a motherhood wage penalty\footnote{Insignificant coefficient of the interaction term between a dummy of being Black and a dummy of having a child under age 6 in a pooled OLS regression with log hourly wage as the dependent variable, using} that is substantial for white women. However, there

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4
is no explanation provided up to date.

In the female labor supply literature, it is also a puzzle that Black women had a higher labor force participation than white women from 1870 until 1980. The striking racial difference in female labor supply remains after controlling for environmental, economic, and family variables (Goldin, 1977) or other economic and demographic observables (Boustan and Collins, 2014). Once again, gender norms are considered the leading candidate to explain the racial gap in female labor supply (Goldin, 1977).

2.3 Racial difference in gender norms

Scarborough et al. (2021) document that Black men and women have more progressive gender attitudes than their white counterparts, using General Social Survey from 1977 to 2018. Historians provide two views on why black households have developed less conservative gender norms. First, slavery may have undermined the conservative gender identities in black households. The slavery system may have changed the ideology of womanhood as black women had to work intensively in manual labor, and the slave system harshly discouraged male supremacy in Black men (Davis, 1981).

On the other hand, less conservative gender norms in Black households may result from racial discrimination in the construction of male supremacy. First, the working-class version of modern manliness is constructed by women’s exclusion from paid labor (Melosh, 1993). Powerful manhood identity is a political language, and such construction deliberately excluded other races, refusing to concede that men of other races were equally manly as white men (Bederman, 1995). As Bederman explains, under gender and racial hierarchy, the gender identity of white men was constructed as self-controlled protectors of women and children and white women as motherly and dedicated to the home. In contrast, non-white men and women were almost identical.
3 Reduced-form method and data

3.1 Event study decomposition

I follow the specification of event study decomposition, which is extensively used by the child penalty literature (Andresen and Nix, 2022; Angelov et al., 2016; Cortés and Pan, 2020; Kleven et al., 2019a).

However, I add individual fixed effects to account for endogenous timing across women entering motherhood earlier or later. Otherwise, a sharp reduction in the average wage following childbirth can be driven by lower-wage women entering motherhood earlier than other women. Therefore, only within-individual variation is used.

\[
Y_{it} = \alpha^{'}D^{Event}_{it} + \beta^{'}D^{Age}_{it} + \gamma^{'}D^{Year}_{it} + \nu_{i} + \varepsilon_{it} \tag{1}
\]

where \(Y_{it}\) is the annual labor income (adjusted by inflation index and transformed by inverse hyperbolic sine) or labor supply (participation dummy or annual hours worked if participating) of individual \(i\) at event time \(t\). The first term includes event time dummies, indexed such that \(t = 0\) denotes the year of the arrival of the first child and omits the dummy for \(t = -1\) so that each \(\alpha^{'}\) measures the impact of children each year relative to the year before the child’s arrival. The second and third terms include a full set of age and year dummies to control nonparametrically for life cycle trends and time trends. This specification is run separately for white women, black women, and men\(^2\).

Similar to Kleven et al. (2019b) and Kleven (2023), the estimated effects are converted into percentage effects by calculating

\[
P_{t}^{g} = \frac{\hat{\alpha}_{t}^{g}}{\mathbb{E}[\hat{Y}_{it}^{g}|t]} \tag{2}
\]

Where \(\hat{Y}_{it}^{g}\) is the average predicted outcome, excluding the contribution of the event time coefficients, as the counterfactual outcome absent children. Finally, the child penalty is

\(^2\)Men are not separately run by race as I find that neither black nor white men have their labor market outcomes affected by childbirth.
constructed as the average effect of having children on women compared to the effect on men.

$$\text{child penalty} = \mathbb{E}[P^m_t - P^w_t | t \geq 0] - \mathbb{E}[P^m_t - P^w_t | t < 0]$$ (3)

Furthermore, the short-run penalty is defined as the average percentage by which women’s labor outcome falls behind men one to five years after the first child’s arrival. The long-run penalty is the average penalty from six to ten years after the first child’s arrival.

3.2 Individual fixed effects

Without individual fixed effects, the identification assumption is that the age of childbirth is exogenous. This may not be true if lower-wage women choose to enter motherhood earlier. With sorting into the age to become a mother, the coefficient will be a combination of selection into early motherhood and the true effect of children on women’s careers. Table 1 shows the empirical correlation in PSID between the age of the first child and women’s wages, labor income, employment rate, and education (5-year average before childbirth) after controlling for age profile and calendar year. It is clear that women with higher prior childbirth wage, labor income, and education tend to enter motherhood later, after controlling for age profile and macro calendar year. Furthermore, there are racial differences in endogenous sorting into early motherhood. Table 2 shows that white women with high wages have late childbirth, and Black women with a higher employment rate (5-year average before childbirth) have later childbirth. In addition, women with higher labor income and education have later motherhood than others.

3.3 Monte Carlo Simulation

To demonstrate the bias, I report results from 500 Monte Carlo Simulations where I simulate different levels of sorting in the age of first childbirth. Shown in equation 4, with a data-generating process designed to mimic actual data, I simulate the age of the first childbirth,
Table 1: The determinants of the age of first childbirth

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior childbirth log wage</td>
<td>1.100***</td>
<td>(0.218)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior childbirth log labor income</td>
<td>6.464***</td>
<td>(0.658)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year of schooling</td>
<td></td>
<td>0.843***</td>
<td>(0.021)</td>
<td></td>
</tr>
<tr>
<td>Employment rate</td>
<td></td>
<td></td>
<td>0.770***</td>
<td>(0.204)</td>
</tr>
<tr>
<td>Constant</td>
<td>26.600***</td>
<td>(0.076)</td>
<td>26.705***</td>
<td>(0.115)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.034***</td>
<td>(0.283)</td>
<td>27.056***</td>
</tr>
<tr>
<td>Observations</td>
<td>3583</td>
<td>5103</td>
<td>7615</td>
<td>5886</td>
</tr>
</tbody>
</table>

Notes: Wage, labor income, and employment (five-year average before childbirth) are detrended by age profile and calendar years. They are calculated based on the 5-year average before childbirth. Sample: PSID individuals’ first child between the ages of 20 and 45. Standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01.

Depending on the random draw of the log-normal distribution with the mean and variance using empirical moments in the PSID, as shown in Figure 2. Next, I also allow it to depend on the education (year of schooling, \(S_i\)), which is empirical as shown in Table 1. The parameter \(\theta\) reflects the level of sorting into later childbirth. I set it to be \((-0.1, 0, 0.1, 0.2, 0.3, 0.4)\) respectively. For each \(\theta\), I conduct 500 Monte Carlo simulations. Wage is assumed to be determined by the level of child penalty, having a child or not, a random shock drawn from a normal distribution with mean 0 and standard deviation 1, and age profiles and macro year trends. The latter two are calibrated using empirical estimates from PSID. The coefficient of the year of schooling on wage is fixed at 0.5.

\[
A_i = \theta S_i + \xi_i
\]

Where \(\xi_i\) follows a log-normal distribution with parameters that I calibrate using empirical moments from PSID.

\[
W_{it} = -0.2K_{it} + \hat{\beta}' D_{it}^{Age} + \hat{\gamma}' D_{it}^{Year} + 0.5S_i + eit
\]
Table 2: The determinants of the age of first childbirth by race

<table>
<thead>
<tr>
<th></th>
<th>White women</th>
<th></th>
<th>Black women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>Prior wage</td>
<td>1.25</td>
<td>0.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior income</td>
<td>6.87</td>
<td>3.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.74)</td>
<td>(1.54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>0.90</td>
<td>0.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>-0.31</td>
<td>1.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.09)</td>
<td>(0.13)</td>
<td>(0.34)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Observations</td>
<td>2941</td>
<td>4239</td>
<td>5775</td>
<td>4447</td>
</tr>
</tbody>
</table>

Notes: Wage, labor income, and employment (five-year average before childbirth) are detrended by age profile and calendar years. They are calculated based on the 5-year average before childbirth. Sample: PSID individuals’ first child between the ages of 20 and 45. Standard errors are in parentheses.

As shown in Table 3, without individual fixed effect, the child penalty estimate is only close to the true value if there is no sorting in the age of first childbirth such that $\theta = 0$. However, suppose the year of schooling is correlated with both the age of first childbirth (which is true empirically in PSID, as shown before). In that case, the estimates without using individual fixed effects are severely biased. By contrast, estimates with individual fixed effects always converge to the true value of child penalty $-0.2$.

Table 3: Monte Carlo simulations with child penalty equal to $-0.2$

<table>
<thead>
<tr>
<th>Sorting $\theta$</th>
<th>True penalty</th>
<th>Without individual fixed effects</th>
<th>With individual fixed effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Main estimates</td>
<td>Standard Devi.</td>
</tr>
<tr>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.146</td>
<td>0.011</td>
</tr>
<tr>
<td>0.0</td>
<td>-0.2</td>
<td>-0.217</td>
<td>0.011</td>
</tr>
<tr>
<td>0.1</td>
<td>-0.2</td>
<td>-0.237</td>
<td>0.010</td>
</tr>
<tr>
<td>0.2</td>
<td>-0.2</td>
<td>-0.342</td>
<td>0.010</td>
</tr>
<tr>
<td>0.3</td>
<td>-0.2</td>
<td>-0.442</td>
<td>0.011</td>
</tr>
<tr>
<td>0.4</td>
<td>-0.2</td>
<td>-0.486</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Notes: Monte Carlo simulations with 500 replicates for each sorting parameter $\theta$. Each sample consists of the real sample of 7,216 women. PSID has 7,926 women in total, but 710 are missing years of schooling information.
3.4 PSID

Data comes from the Panel Study of Income Dynamics (PSID) from 1968 to 2019. The study began in 1968 with a nationally representative sample of over 18,000 individuals living in 5,000 families in the United States. Sample selection criteria follow Kleven et al. (2019a) and Cortés and Pan (2020) to include only individuals with their first child between the ages of 20 and 45. Observations include only between ages 18 to 65.

Table 4 shows the summary statistics before and after childbirth by race and marital status. On average, black women are more economically disadvantaged. Husbands of white women have higher annual labor income and hourly wages than husbands of black women. For homeownership, married Black women are less likely to own the place where they live. Five years after the first childbirth, black women are less likely to have their husbands being against their wives working, less likely to own the house, and have less non-labor income. Black women are more likely to be government workers.

Homeownership is highest among married white women, followed by married black women, single white women, and single black women. Therefore, annual mortgage payment for housing follows the same pattern. In addition, married black women are most likely to grow up in larger family sizes than the rest. After childbirth, married white women’s annual hours worked and employment rate becomes the lowest compared to black or single women.

3.5 Control for the distribution of covariates between black and white women

As shown in Table 4, Black and white women are in very different economic and demographic situations. Therefore, I use inverse probability weights to ensure that after reweighting, Black women have a nearly identical distribution of these covariates to white women.

For example, black husbands’ labor income is lower than white husbands, as shown in Figure 2a. After reweighting, there is almost no racial difference in the distribution of husband
Table 4: Summary statistics between black and white mothers

<table>
<thead>
<tr>
<th></th>
<th>Married mother</th>
<th></th>
<th>Single mother</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
<td>Black</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td><strong>3-year average before childbirth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>25.88</td>
<td>25.49</td>
<td>24.80</td>
<td>24.33</td>
</tr>
<tr>
<td>(Husband) labor income</td>
<td>6318.71</td>
<td>4680.19</td>
<td>5156.34</td>
<td>2955.25</td>
</tr>
<tr>
<td>Annual labor income</td>
<td>2988.71</td>
<td>2383.41</td>
<td>2308.65</td>
<td>708.70</td>
</tr>
<tr>
<td>(Husband) hourly wage</td>
<td>2.97</td>
<td>2.37</td>
<td>2.62</td>
<td>1.70</td>
</tr>
<tr>
<td>Hourly wage</td>
<td>2.05</td>
<td>1.60</td>
<td>1.34</td>
<td>0.47</td>
</tr>
<tr>
<td>Employment rate</td>
<td>0.76</td>
<td>0.70</td>
<td>0.85</td>
<td>0.76</td>
</tr>
<tr>
<td>Annual hours worked</td>
<td>1247.30</td>
<td>1182.56</td>
<td>1604.05</td>
<td>1371.70</td>
</tr>
<tr>
<td>Government worker</td>
<td>0.19</td>
<td>0.31</td>
<td>0.18</td>
<td>0.30</td>
</tr>
<tr>
<td>Homeowner</td>
<td>0.31</td>
<td>0.21</td>
<td>0.14</td>
<td>0.07</td>
</tr>
<tr>
<td>South</td>
<td>0.31</td>
<td>0.69</td>
<td>0.25</td>
<td>0.63</td>
</tr>
<tr>
<td>Household structure*</td>
<td>0.07</td>
<td>0.94</td>
<td>0.63</td>
<td>0.65</td>
</tr>
<tr>
<td>Family non-labor income</td>
<td>789.82</td>
<td>498.56</td>
<td>981.08</td>
<td>633.91</td>
</tr>
<tr>
<td>Year of schooling</td>
<td>14.24</td>
<td>13.77</td>
<td>14.36</td>
<td>14.18</td>
</tr>
<tr>
<td>Total number of sisters</td>
<td>1.18</td>
<td>1.80</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Her mother’s number of children</td>
<td>3.51</td>
<td>5.43</td>
<td>3.51</td>
<td>4.87</td>
</tr>
<tr>
<td>Annual housing mortgage ($)</td>
<td>685.44</td>
<td>250.56</td>
<td>143.40</td>
<td>52.59</td>
</tr>
<tr>
<td>Observations</td>
<td>6619</td>
<td>1171</td>
<td>1120</td>
<td>782</td>
</tr>
<tr>
<td>n</td>
<td>2996</td>
<td>594</td>
<td>708</td>
<td>406</td>
</tr>
<tr>
<td><strong>3-year average after childbirth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>28.33</td>
<td>27.25</td>
<td>27.03</td>
<td>26.49</td>
</tr>
<tr>
<td>(Husband) labor income</td>
<td>7138.05</td>
<td>4686.98</td>
<td>3061.56</td>
<td>2397.78</td>
</tr>
<tr>
<td>Annual labor income</td>
<td>2001.69</td>
<td>2184.34</td>
<td>599.53</td>
<td>302.15</td>
</tr>
<tr>
<td>(Husband) hourly wage</td>
<td>3.29</td>
<td>2.28</td>
<td>1.65</td>
<td>1.40</td>
</tr>
<tr>
<td>Hourly wage</td>
<td>1.57</td>
<td>1.40</td>
<td>0.42</td>
<td>0.23</td>
</tr>
<tr>
<td>Employment rate</td>
<td>0.60</td>
<td>0.68</td>
<td>0.72</td>
<td>0.64</td>
</tr>
<tr>
<td>Annual hours worked</td>
<td>777.47</td>
<td>1121.04</td>
<td>1014.15</td>
<td>997.72</td>
</tr>
<tr>
<td>Government worker</td>
<td>0.19</td>
<td>0.27</td>
<td>0.13</td>
<td>0.29</td>
</tr>
<tr>
<td>Homeowner</td>
<td>0.32</td>
<td>0.21</td>
<td>0.09</td>
<td>0.06</td>
</tr>
<tr>
<td>South</td>
<td>0.31</td>
<td>0.70</td>
<td>0.34</td>
<td>0.62</td>
</tr>
<tr>
<td>Household structure*</td>
<td>0.97</td>
<td>0.94</td>
<td>0.76</td>
<td>0.78</td>
</tr>
<tr>
<td>Family non-labor income</td>
<td>977.67</td>
<td>658.61</td>
<td>1404.58</td>
<td>646.15</td>
</tr>
<tr>
<td>Year of schooling</td>
<td>14.11</td>
<td>13.59</td>
<td>12.74</td>
<td>12.62</td>
</tr>
<tr>
<td>Total number of sisters</td>
<td>1.26</td>
<td>1.79</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Her mother’s number of children</td>
<td>3.50</td>
<td>4.93</td>
<td>3.75</td>
<td>4.91</td>
</tr>
<tr>
<td>Annual housing mortgage ($)</td>
<td>909.55</td>
<td>366.09</td>
<td>176.32</td>
<td>49.93</td>
</tr>
<tr>
<td>Observations</td>
<td>7481</td>
<td>1802</td>
<td>604</td>
<td>943</td>
</tr>
<tr>
<td>n</td>
<td>3575</td>
<td>883</td>
<td>437</td>
<td>548</td>
</tr>
</tbody>
</table>

**Notes:** *Binary indicator if there are no relatives (including grandparents and siblings) or non-relatives living in the households. The sample consists of women having their first child between 20 and 45. Only observations between the ages of 18 to 65. Income, wage, and mortgage payments are adjusted by the inflation index (1960 price). Source: Panel Study of Income Dynamics, 1968 to 2019.*
Notes: The sample consists of women as the head of their households, having their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Source: Panel Study of Income Dynamics, 1968 to 2019.

labor income.

3.6 Other data source

Bureau of Justice Statistics I use the yearly incarceration rate by state from the Bureau of Justice Statistics, which provides the imprisonment rate of sentenced male prisoners under the jurisdiction of the state or federal correctional authorities per 100,000 male US residents.


Divorce laws in the US Following Voena (2015), I exploit the effect of changes in divorce laws as plausible exogenous variations as instruments for marriage rate, divorce rate, and fertility rate by race. The Property division regime changes can be broadly classified into three main analyses. Title-based regimes allocate assets according to the title of ownership. Community property regimes allocate assets equally between spouses. Equitable distribution regimes allow courts to decide on dividing marital assets for equity purposes, such as a division favoring the one in higher financial need.
Figure 2: The racial difference in the distribution of husband labor income

Notes: Husband labor income is the 11-year average (5 years before and after childbirth) and transformed by inverse hyperbolic sine. The sample consists of women as the head of their households, having their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Source: Panel Study of Income Dynamics, 1968 to 2019.

4 Child penalties by race

4.1 Married women

Figure 3 shows the racial differences in the child penalties between black and white married women. The long-run child penalty in labor earnings is around 44% for white women while around 22% for black women. The racial gap is driven by all margins, including participation rate, annual hours worked conditional on employment, and wage rate.

4.2 Single women

In Appendix Figure A.3, I present the child penalties among single women. There are no statistically significant differences in child penalties between Black and white single women. In terms of marital status, married White women have the largest child penalties, followed by single women regardless of race, then Black married women with the smallest child penalties.
Figure 3: Racial differences in the child penalties among married women

Notes: The sample consists of married women in male-headed households with their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Wage and income are transformed by inverse hyperbolic sine. Annual hours worked are conditional on being employed. Source: Panel Study of Income Dynamics, 1967 to 2017.

4.3 Other heterogeneity

As married women drive the racial gap in the child penalties, the entire analysis onwards is carried out using the sample of married women in male-headed households. The heterogeneity analysis divides women by region, wage, family non-labor income, homeownership, and family structure.

First, figure 4 shows that high-wage women drive the racial gap in child penalties, while there is no racial gap among women with a wage below the female median. I first measure the median wage per year among childless women in the PSID. Then, I construct a binary
indicator if her wage (1 year before childbirth) is above the median female wage of that year. In addition, figure 5 shows that women in the South drive the racial gap, while there is no racial difference in the child penalties in the other regions.

Figure 4: Racial difference in the child penalties by prior wage

Notes: The sample consists of married women in male-headed households with their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Wage and income are transformed by inverse hyperbolic sine. Annual hours worked are conditional on being employed. Source: Panel Study of Income Dynamics, 1967 to 2017.

Finally, the racial gap remains unchanged when I look at different subsamples by other heterogeneity analyses, such as family non-labor income, homeownership, or household composition (women living in a family structure with only a husband, wife, and children), as shown in the Figure A.4 and A.5 in the appendix.

In addition, I also run the event study analysis with household composition as the outcome
Figure 5: Racial differences in the child penalties by region

Notes: The sample consists of single women as the head of their households, having their first child between 20 and 45.

variable. I find that parenthood does not affect other family members moving into the household, as shown in figure ??.

4.4 Fully control for the racial gap in the distribution of covariates

I use inverse probability weighting (IPW) to construct the new weights such that Black women have an almost identical distribution of covariates compared to white women. This section first explains all covariates controlled for. The second part presents the racial gap in child penalties before and after IPW.

Wife characteristics First, the racial difference in the distribution of her own character-
istics is controlled for. Such prior childbirth covariates include wage, occupation, industry, working as a government worker, having a job paying for life insurance, and her year of schooling.

**Husband characteristics** I also control for the racial differences in the distribution of husband characteristics, such as annual labor income (simultaneously control for husband employment status), hourly wage, and husband attitude against wife working (5-item index in a survey question). **Volatility, assets, and risks** To control for the racial gap in financial distress, I control for the racial differences in the distribution of uncertainty, such as the standard deviation of husband labor income (10 years around childbirth) and the expected probability of husband laid off (a survey question asking the husband to estimate the probability that he may be laid off in the next 12 months, ranging from 0 percent to 100 percent). I also control for the racial difference in the distribution of family non-labor income and the standard deviation (10 years around childbirth). In addition, I also control for the racial difference in annual debts or mortgage payments.

**Informal help** As a proxy for informal help from family members, I control for the racial difference in the number of relatives living within walking distance and the number of sisters the women have. As shown in Table 5, the child penalty for black women virtually does not change even after we use inverse probability weighting such that Black women have an almost identical distribution of covariates we have discussed above.
Table 5: Short-run labor income penalty with and without IPW

<table>
<thead>
<tr>
<th>IPW covariates</th>
<th>White Women</th>
<th>No IPW Black Women</th>
<th>IPW Black Women</th>
<th>No IPW Racial Gap</th>
<th>IPW Racial Gap</th>
<th>P.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wife characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female wage</td>
<td>41%</td>
<td>22%</td>
<td>18%</td>
<td>-19%</td>
<td>-23%</td>
<td>-0.04</td>
</tr>
<tr>
<td>Government worker</td>
<td>38%</td>
<td>20%</td>
<td>21%</td>
<td>-18%</td>
<td>-17%</td>
<td>0.01</td>
</tr>
<tr>
<td>Female industry</td>
<td>42%</td>
<td>24%</td>
<td>25%</td>
<td>-18%</td>
<td>-17%</td>
<td>0.01</td>
</tr>
<tr>
<td>Female occupation</td>
<td>37%</td>
<td>22%</td>
<td>22%</td>
<td>-15%</td>
<td>-15%</td>
<td>0.00</td>
</tr>
<tr>
<td>Wife’s job pays for life insurance</td>
<td>42%</td>
<td>24%</td>
<td>23%</td>
<td>-18%</td>
<td>-19%</td>
<td>-0.01</td>
</tr>
<tr>
<td>Female year of schooling</td>
<td>42%</td>
<td>19%</td>
<td>21%</td>
<td>-23%</td>
<td>-21%</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Husband characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Husband labor income</td>
<td>40%</td>
<td>21%</td>
<td>19%</td>
<td>-19%</td>
<td>-21%</td>
<td>-0.02</td>
</tr>
<tr>
<td>Husband hourly wage</td>
<td>40%</td>
<td>21%</td>
<td>21%</td>
<td>-20%</td>
<td>-20%</td>
<td>0.00</td>
</tr>
<tr>
<td>Husband Attitude</td>
<td>45%</td>
<td>24%</td>
<td>22%</td>
<td>-21%</td>
<td>-24%</td>
<td>-0.02</td>
</tr>
<tr>
<td><strong>Assets and risks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Husband labor income (sd)</td>
<td>41%</td>
<td>21%</td>
<td>20%</td>
<td>-19%</td>
<td>-21%</td>
<td>-0.01</td>
</tr>
<tr>
<td>Probability husband laid off</td>
<td>38%</td>
<td>15%</td>
<td>15%</td>
<td>-23%</td>
<td>-22%</td>
<td>0.00</td>
</tr>
<tr>
<td>Family non-labor income</td>
<td>41%</td>
<td>21%</td>
<td>21%</td>
<td>-20%</td>
<td>-20%</td>
<td>0.00</td>
</tr>
<tr>
<td>Family non-labor income (sd)</td>
<td>42%</td>
<td>19%</td>
<td>15%</td>
<td>-23%</td>
<td>-26%</td>
<td>-0.04</td>
</tr>
<tr>
<td>Debt</td>
<td>40%</td>
<td>16%</td>
<td>15%</td>
<td>-24%</td>
<td>-24%</td>
<td>-0.01</td>
</tr>
<tr>
<td>Annual mortgage payment</td>
<td>41%</td>
<td>22%</td>
<td>19%</td>
<td>-19%</td>
<td>-22%</td>
<td>-0.02</td>
</tr>
<tr>
<td><strong>Family structure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relatives live in working distance</td>
<td>53%</td>
<td>16%</td>
<td>18%</td>
<td>-37%</td>
<td>-35%</td>
<td>0.01</td>
</tr>
<tr>
<td>Total number of sisters</td>
<td>39%</td>
<td>16%</td>
<td>15%</td>
<td>-23%</td>
<td>-24%</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

**Notes:** Short-run (long-run) penalty is the average child penalty between 1-5 (6-10) years after childbirth. Her Prior wage is one year before childbirth. Industry is 1 to 5 years before childbirth. Husband labor income is the average of 10 years after childbirth. Family non-labor income is the total of 10 years after childbirth. The husband attitude question asks, “How do you feel about your (Wife/friend) working/the possibility of your (Wife/ friend) working? Are you very much in favor of it, somewhat in favor of it, neither for nor against it, somewhat against it, or very much against it?” The sample consists of married women in male-headed households, having their first child between 20 and 45. Income and wage are adjusted by the inflation index (1960 price) and transformed by inverse hyperbolic sine. Source: Panel Study of Income Dynamics, 1967 to 2017.
5 Life cycle model of female labor supply, marriage and divorce

Previous section 4 documents that racial difference in child penalty cannot be explained by contemporaneous covariates. Given the substantial racial difference in the marriage and divorce rates, can the racial difference in female labor supply be driven by the racial difference in uncertainty of household formation? The hypothesis is that, with higher expectation in divorce, Black women with high wages stay in the labor market to increase future wage offer through human capital accumulation or to increase precautionary savings to smooth consumption.

The aim of the structural model is to examine if racial gap in child penalties can be obtained solely by racial difference in marriage and divorce rates while Black and white women have identical parameters, including preferences, discounting factor, childcare costs etc.

5.1 Racial gap in marriage, fertility, and divorce

For a balanced panel, I use PSID individuals who are fully observed from age 20 to 40 and have their first child between age 20 and 40. After the selection, 348 black women and 1220 white women are in the balanced PSID panel where employment history and fertility are observed, and wage is partially observed conditional on employment. As shown in Figure 6, since age 25, white women’s labor supply has a declined U shape throughout their life course, while Black women have a much higher labor supply without such a U shape. By contrast, the marriage gap becomes substantially larger after 30. This motivates this paper to investigate if future marriage shock may motivate high-wage Black women to stay in the labor market as a mean to self-insure if future wage depends on human capital accumulation.
5.2 Outline of the model

I assume that a household consists of two adult members, a husband $m$ and a wife $f$.

**Male labor supply** For simplicity, the husband always works full time, meaning that his labor hours are equal to 1. He is equipped with an exogenous labor productivity.

\[
  h_{m,j} = e_j \exp[\theta + \eta_{m,j}] \tag{6}
\]

which is due to the exogenous age-productivity profile $e_j$, a household-specific permanent productivity component $\theta$ and an individual-specific autoregressive component $\eta_{m,j}$. Supplying $h_{m,j}$ units of productive labour to the market, the husband generates a labor income $y_{m,j} = w_m h_{m,j}$ where $w_m$ denotes the wage rate of men. Labor productivity drops to zero at the exogenous retirement age $j_r$ and the household starts receiving a pension, which is calculated from

\[
  pen_{j} = \begin{cases} 
  0 & \text{if } j \leq j_r \\
  \kappa \frac{w_m}{j_r-1} \sum_{j=1}^{j_r-1} e_j & \text{if } j \geq j_r 
  \end{cases} \tag{7}
\]
I estimate the age-specific transition of marriage and divorce rate by race using PSID. While male income, fertility and marriage are exogenous, they are driven by stochastic processes. The results are conditional on the observed status quo process of family formation.

**Female labor supply** The female household member is equipped with an initial level of human capital $h_{f,1}$. At each point in time she has to decide whether to participate in the labor market $l_j = 1$ or whether to stay at home $l_j = 0$. Participation in the labor market generates positive spillovers to future periods in the form of experience effects. Specifically, we assume that the human capital of the woman evolves over time according to

$$\log(h_{f,j+1}) = \max[\log(h_{f,j} + \xi_1 + \xi_2 j)l_j - \delta_h(1 - l_j), \log h_{f,1}]$$  \hspace{1cm} (8)

Experience effect of one year of work on human capital accumulation is age-specific. In addition, a year of staying at home causes a depreciation of human capital at rate $\delta_h$. In addition, human capital cannot fall below its initial level $h_{f,1}$. In addition, female labor income in the labor market depends on the household-specific permanent productivity component $\theta$, an individual-specific autoregressive shock $\eta_{f,j}$, as well as the wage rate of women $w_f$. In total, female labor income is

$$y_{f,j} = w_f h_{f,j} \exp \theta + \eta_{f,j} l_j$$  \hspace{1cm} (9)

**Childcare** I assume each women has a total of 2 children. To keep things as possible, the household does not decide the number of children nor their spacing. The first child arrives when the women is aged 30 and second when the women is aged 32. I assume that the child lives in the household for 18 years. Children consume resources. The childcare costs depends on the number and ages of children in the household. The model assumes that the costs of childcare evolve exogenously and can be fully characterised by an age-specific variable.

**Utility** The women decide how much to consume $c_j$, how much to save for the future $a_{j+1}$, and whether she should participate in the labor market or not $l_j$. She has preferences over consumption and labor supply, which can be represented by a time-separable expected utility
function of the form
\[ E \left[ \sum_{j=1}^{J} \beta^{j-1} \left( \prod_{i=1}^{j} \psi_{i} \right) u(c_{j}, l_{j}) \right] \] (10)

where instantaneous utility is given by
\[ u(c_{j}, l_{j}) = \frac{1}{1 - \frac{1}{\gamma}} \left[ \frac{c_{j}}{\sqrt{2 + n_{j}}} \right]^{1 - \frac{1}{\gamma}} - \nu l_{j} \] (11)

For simplicity, I assume that survival from one period to the next one is stochastic and both parents die exactly at the same date if still married. The dynamic budget constraints read
\[ a_{j+1} + c_{j} = (1 + r)a_{j} + M_{j}y_{m,j} + y_{f,j} + pen - p_{j}l_{j} \] (12)

\[ M_{j} = 1 \text{ if she is married and zero otherwise. } M_{j} \text{ is the only racial difference in the model and empirically obtained from PSID.} \]

### 5.3 The dynamic programming problem

The household’s state vector can be written as
\[ z = (j, a, h_{f}, \theta, \eta_{m}, \eta_{f}) \] (13)

The dynamic programming problem is
\[
\max_{c, l, a^+} \quad u(c, l) + \beta \psi_{j+1} E \left[ V(Z^+) | \eta_{f}, \eta_{m} \right]
\]

s.t. \[ a^+ + c = (1 + r)a + y_{m}M_{j} + y_{f} + pen - p_{j}l, \]
\[ a^+ \geq 0, \]
\[ \log(h_{f}^+) = \max \log(h_{f}) + (\xi_{1} + \xi_{2}j)l - \delta_h(1 - l), \log(h_{f,1}). \]
\[ \eta_{m}^+ = \rho \eta_{m} + \epsilon_{m}^+ \]
\[ \eta_{f}^+ = \rho \eta_{f} + \epsilon_{f}^+ \] (14)
where $\epsilon_{m}^{+}$ and $\epsilon_{f}^{+}$ both follow a normal distribution $\mathcal{N}(0, \sigma_{\epsilon}^{2})$ and $\zeta^{+} = (j+1, a^{+}, h^{+}, \theta, \eta_{m}^{+}, \eta_{f}^{+})$.

For simplicity, stochastic processes $\eta_{m}$ and $\eta_{f}$ are assumed independent although they have identical autocorrelations and variances. The solution involves two steps.

1. **Consumption-saving choice** Conditional on the women participates in the labor market, savings can be determined by solving the conditional optimization problem

\[
\hat{V}(z, l) = \max_{c, a^{+}} \frac{1}{1 - \frac{1}{\gamma}} \left[ \frac{c_{j}}{\sqrt{2 + n_{j}}} \right]^{1 - \frac{1}{\gamma}} - ul_{j} + \beta \psi_{j+1} E \left[ V(Z^{+}) | \eta_{f}, \eta_{m} \right] \\
\text{s.t.} \quad a^{+} + c = (1 + r)a + y_{m}M_{j} + y_{f} + pen - p_{j}l, \quad a^{+} \geq 0, \tag{15}
\]

The first-order condition becomes

\[
\frac{c^{\frac{1}{\gamma}}}{\left[ \sqrt{2 + n_{j}} \right]^{1 - \frac{1}{\gamma}}} = \beta \psi_{j+1} E \left[ V(Z^{+}) | \eta_{f}, \eta_{m} \right] \tag{16}
\]

Use the envelope theorem to obtain

\[
V_{c}(z^{+}) = (1 + r) \frac{c(z^{+})^{-\frac{1}{\gamma}}}{\left[ \sqrt{2 + n_{j+1}} \right]^{1 - \frac{1}{\gamma}}} \tag{17}
\]

The intertemporal first-order condition becomes

\[
\frac{c}{\left[ \sqrt{2 + n_{j}} \right]^{1 - \gamma}} = \left\{ \beta \psi_{j+1}(1 + r) E \left[ \frac{c(z^{+})^{-\frac{1}{\gamma}}}{\left[ \sqrt{2 + n_{j+1}} \right]^{1 - \frac{1}{\gamma}}} | \eta_{f}, \eta_{m} \right] \right\}^{-\gamma} \tag{18}
\]

2. **Labor force participation decision** Now knowing the utility $\hat{V}(z, l)$ with each choice of labor supply, the utility maximizing is

\[
l(z) = \begin{cases} 
1 & \text{if } V(\hat{z}, 1) \geq V(\hat{z}, 0) \\
0 & \text{Otherwise.} 
\end{cases} \tag{19}
\]
Solving the household problem The solution is solved by backward iteration. First, last period decision process is computed, then iterate backward over ages until age 20, and compute household decisions for each element $z$ of the state space at each age $j$.

Calibration and simulation I make the standard assumption on preference parameters, autocorrelation and variance of the shock processes, survival probabilities and the labour productivity profile. For human capital accumulation, I let $\xi_1 = 0.04$ and $\xi_2 = -0.002$. This choice guarantees that the age-productivity profile of women would be almost identical to the productivity profile of men if women work full-time throughout working age. In addition, human capital depreciation rate is set to be $\delta_h = 0.07$ and utility cost of labor participation is $\nu = 0.12$. Wage rate of men is set as $w_m = 1$ and $w_f = 0.75$.

5.4 Results

All parameters, including preferences, discounting factors, and childcare costs, are identical for Black and white women. The only racial difference in the model is the age-specific marriage rate calibrated using empirical moments in PSID.

![Figure 7: Female labor force participation](image)
Figure 7 shows life-cycle profiles generated from the model. Upon the arrival of the first child at age 30, female labor force participation has declined as a large proportion of women stop working and stay home to care for the child. However, the detachment of labor market of Black women is much smaller. Similarly, as shown in Figure 8, since the first childbirth,
the net human capital starts to decline for white women as accumulation is smaller than depreciation. However, the human capital remains a constant for Black women. Similarly, the wage rate as shown in Figure 9 shows the wage gap between Black and white women diverge since the first childbirth. With identical parameters among preference, childcare cost, discounting factors, the model is able to produce very similar patterns as empirical estimates of child penalties only using racial difference in marriage and divorce rates. This suggests that labor market attachment to keep human capital from depreciation is a self insurance device against future marriage shock.

6 Conclusion

This study shows striking differences in child penalties between black and white women in the US. This paper largely rules out the main explanation of single parenthood, family structure, and homeownership. Furthermore, most economics, demographic, and work-related gender attitude variables do not explain most of the racial gap in child penalty. Heterogeneity analysis shows that the racial gap is primarily driven by women in the South with high wages. Consistently, the structural model of lifecycle modeling of employment produces very similar empirical patterns of child penalties between Black and white women, using only racial difference in marriage rate with identical parameters for Black and white women. This suggests that Black women stay in the labor market to keep human capital from depreciation to self-sure against future divorce shock.
References


A Appendix


Figure A.1: Racial differences in the child penalties

Notes: The sample consists of married women in male-headed households with their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Wage and income are transformed by inverse hyperbolic sine. Annual hours worked are conditional on being employed. Source: Panel Study of Income Dynamics, 1967 to 2017.

A.2 Child penalties by family composition
Notes: The sample consists of married women in male-headed households with their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Wage and income are transformed by inverse hyperbolic sine. Annual hours worked are conditional on being employed. Source: Panel Study of Income Dynamics, 1967 to 2017.
Figure A.3: Racial difference in the child penalties (single women)
Figure A.4: Racial differences in the child penalties by family non-labor income

(a) Non-labor income above the median

(b) Non-labor income below the median
(a) Owns this home or apartment

(b) Rent this home or apartment

Figure A.5: Racial differences in the child penalties by homeownership

Notes: The sample consists of married women in male-headed households with their first child between 20 and 45. Income and wage adjusted by inflation index (1960 price). Wage and income are transformed by inverse hyperbolic sine. Annual hours worked are conditional on being employed. Source: Panel Study of Income Dynamics, 1967 to 2017.
Appendix: Reweighting the distribution of covariates

Figure B.1: Prior female wage

Figure B.2: Husband labor income

Husband attitude (survey questions in 1976 and 1977) Survey question in 1976, “How does your husband feel about (your working/the possibility of your working)? Is he very much in favor of it, somewhat in favor of it, neither for nor against it, somewhat against it, or very much against it?”
Survey question in 1977, “How do you feel about your (Wife/friend) working/the possibility of your (Wife/friend) working? Are you very much in favor of it, somewhat in favor of it, neither for nor against it, somewhat against it, or very much against it?”

34
Figure B.3: Prior her industry

Figure B.4: Prior her occupation

The answer range is (Very much in favor, Somewhat in favor, Neither for nor against, Somewhat against, and Very much against)
Figure B.5: Prior family non-labor income

Figure B.6: Her year of schooling
Figure B.7: Husband attitude about the wife working (collected in 1976 and 1977 only)
C Appendix: Event study figure with and without IPW

Figure C.1: Child penalty without and with IPW to control for her prior wage

(a) With IPW

(b) Without IPW
Figure C.2: Child penalty without and with IPW to control for her prior industry
Figure C.3: Child penalty without and with IPW to control for the husband’s labor income
(a) With IPW

(b) Without IPW

Figure C.4: Child penalty without and with IPW to control for her husband’s attitude about the wife working