ABSTRACT

Title of dissertation: THE EFFECTS OF THE INCARCERATION OF FATHERS ON THE HEALTH AND WELLBEING OF MOTHERS AND CHILDREN

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The male incarceration rate has risen dramatically in the last several decades. Over half of incarcerated men are fathers of minor children. My dissertation focuses specifically on families and addresses various aspects of how mothers and children have been affected by the incarceration of fathers.

This research uses data from the Fragile Families and Child Wellbeing Study (FFCWB)[1], a national sample of mostly unwed parents and their children, to estimate the causal effect of the incarceration of fathers on various outcomes for mothers and children.

[1] The Fragile Families Study was funded by a grant from the Eunice Kennedy Shriver NICHD (#R01HD36916) and a consortium of private foundations. Persons interested in obtaining Fragile Families contract data should see http://www.fragilefamilies.princeton.edu for further information.

However, since the female partners and children of incarcerated men differ along observable characteristics from other mothers and children in the FFCWB, they are also likely to differ in terms of unobservables, and thus ordinary least squares estimation is unlikely to provide an unbiased estimate of this causal effect. Instead, I employ propensity score matching methods to estimate this effects, exploiting the rich data availability in FFCWB.

The first chapter introduces these topics and provides a brief discussion. The second chapter discusses the impact of a father's incarceration on the public assistance participation of mothers as measured by welfare and food stamp program participation. A large body of research has examined consequences of incarceration on incarcerated men, while little has analyzed the effect on women who share children with incarcerated men. My research aims to fill this gap. I find robust evidence that, among women with incarcerated partners, a partner's incarceration increases the probability that mothers receive both welfare and food stamp benefits.

The third chapter considers the effect of father's incarceration on the health of mothers and the development of children. The outcome variables I analyze are mothers' physical health and mental health as measured by depression and anxiety, as well as child's cognitive development and social behavior. My findings indicate that, among children with incarcerated fathers, paternal incarceration adversely affects cognitive development and increases aggressive behavior in children at age five. I also find that, among mothers with incarcerated partners, having a partner that is recently incarcerated adversely affect mothers' mental health as measured by depression, but positively affects mothers' physical health.

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by

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Dedication

I would like to dedicate this dissertation to my husband, Arvin Walker, Jr.
Thank you for your love, support, and encouragement.

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Chapter 1

Introduction

The male incarceration rate in the United States has grown considerably over the last 30 years. According to the Bureau of Justice Statistics, there were 139 sentenced male prisoners in State or Federal prisoners per 100,000 U.S. residents in 1980[2]. This number has increased to 949 sentenced male prisoners per 100,000 U.S. residents by 2009[3]. There are currently 2.1 million men held in state or federal prisons or local jails (Sabol, West, and Cooper, 2009) and over half of incarcerated men are also fathers of minor children (Glaze and Maruschak, 2008). An estimated 1.6 million children have fathers in state or federal prison, with three times as many children with fathers under some sort of justice system supervision, including probation or parole (Mumola 2000).

Mass incarceration has far reaching implications that extend beyond the incarcerated individual. There is a growing population of children and families affected by the incarceration of a loved one. When a father is sentenced to prison, his entire family is affected economically, emotionally, and psychologically. This involuntary separation from the family may create financial hardship as well as excessive stress for the family members left behind. This research extends the literature on the social and economic implications of incarceration for offenders and their families. Empirical research focusing specifically on the female partners left behind after a man becomes incarcerated

[2] Beck, Allen J. and Darrell K. Gilliard, "Prisoners in 1994," *Bureau of Justice Statistics Bulletin*, August 1995, NCJ-151654.
[3] West, Heather C. and William J. Sabol, "Prisoners in 2009," *Bureau of Justice Statistics Bulletin*, December 2010, NCJ-231675.

has received little attention in the literature. These women, in many cases mothers, must often bear the economic hardships that results from a partner's incarceration, and are therefore an import group on which to focus. My dissertation addresses various aspects of how the incarceration of fathers affects the wellbeing of mothers and children.

The second chapter examines the impact of incarcerated fathers on the public assistance participation of mothers, where the receipt of public assistance is used as a proxy for mothers' economic wellbeing. Chapter 3 considers how a father's incarceration affects the mental and physical health of mothers. In this chapter, I also analyze the effects of paternal incarceration on the wellbeing of young children.

There are several mechanisms through which incarceration may affect the wellbeing of mothers and children. One avenue is through the effect on the mother's household economic conditions. After a father is imprisoned, he is unable to contribute to the mother's household either financially or through other nonmonetary contributions such as childcare or other in-kind support. The new direct expenses associated with a father's incarceration may also adversely affect the economic condition of mothers. Associated costs may include high charges for telephone calls, postage fees for letters, travel costs for visitation, attorney fees, and money sent directly to the inmate for commissary purchases. In addition to financial effects, paternal incarceration may impact the wellbeing of young children through the involuntary separation of the father from the child at a young age, which may adversely affect child wellbeing. However, the effects of paternal incarceration may not be all negative. If the father was a negative influence on the family, his absence may enhance mother and child wellbeing and health. For example, if the incarcerated father abused drugs or alcohol prior to incarceration and

disproportionately drained the financial resources of the mother's household in support of his substance dependency, his incarceration may temporarily improve the economic condition of mothers.

My dissertation uses data from the Fragile Families and Child Wellbeing Study. This study follows urban, mostly unwed parents and their children beginning with the birth of their child and continues over the course of five years. This data set is very appropriate for this research analysis for several reasons. The study is focused on a unique sample of families residing in urban communities, which are affected by incarceration at high levels. Many of the participants in the survey also display characteristics and backgrounds that are similar to those of the incarcerated population, such as minority, young, low educational attainment, and low income. There is detailed information provided on parent's behavior and conditions that are typically unobserved in household surveys, such as incarceration and drug use. The study also provides a direct assignment of father's incarceration status to the outcomes of mothers and children, which allows me to estimate the direct effect of paternal incarceration within the household.

In the second chapter, I analyze whether the incarceration of fathers affects the public assistance participation of mothers as measured by welfare and food stamp program participation. The direct costs of incarceration are high[4]. These costs do not consider the additional indirect costs that may result from the increase in public assistance participation by the mothers of the children of incarcerated fathers, thus underestimating the true cost of incarceration. Public assistance program expenditures

[4] The average operating cost per state or federal inmate is over $22,000 per year (Stephan, 2001).

may be considered a component of the total cost of incarceration, and it is one that has not yet been studied.

Prior empirical research analyzing the effects of male incarceration on female outcomes has largely focused on the indirect effect of aggregate incarceration rates via changes in marriage market opportunities and considers such outcomes as female employment, education, and fertility[5]. This chapter offers an important extension to this research by examining the direct effect of the incarceration of fathers on the outcomes of mothers who have current relationships with incarcerated men, such as a wives and partners. Because many incarcerated men are fathers, this household level analysis of mothers is an important line of research to consider.

This analysis must overcome empirical challenges stemming from the fact that women who have children with men who become incarcerated are selectively different from mothers whose partners do not become incarcerated. I employ propensity score matching methods to address the non-random selection of mothers with incarcerated partners and to estimate the causal effect of incarceration on the economic condition of mothers. It is difficult to disentangle the effect of having an incarcerated partner from the effect of having a partner that exhibits criminal behavior. My identification strategy attempts to isolate the effect of incarceration by matching mothers with incarcerated partners to other mothers in the sample who have a similar propensity to have a partner that is incarcerated, but whose partner is not, in fact, incarcerated. . The sizes of the effects I estimate are quite large. I find robust evidence that, among mothers with

[5] Charles and Luoh, 2010, Mechoulan, 2010, and Kamdar, 2007

incarcerated partners, the incarceration of fathers increases the probability that mothers receive both types of public assistance by 13-23 percentage points.

Economic wellbeing is one aspect of mother's welfare that may be affected by a father's recent incarceration. In the third chapter, I consider the effect of incarceration on mother's physical and mental health as measured by depression and anxiety. I also consider the impact of paternal incarceration on child wellbeing at ages 3 and 5. The outcomes I consider are cognitive development as measured by the Peabody Picture Vocabulary Test (PPVT), as well as social behavior as measured by aggressive and anxiety/depressive behavior. To address selection bias, I again employ propensity score matching techniques. The results for mothers physical and mental health are largely inconclusive, perhaps due to issues with statistical power in what is a small sample. Among children whose fathers are incarcerated at age 5, paternal incarceration reduces PPVT test scores by 4 points and increases the aggression behavior index by 0.14. However, I find no evidence that paternal incarceration significantly affects cognitive development or behavior for children at age 3.

In both chapters, I find that the ordinary least squares model conditioned on basic demographic characteristics are qualitatively similar to propensity score matching estimates, which condition on an extended set of observable characteristics. This implies that, for this specifically selected sample of mostly unwed mothers, selection bias appears to be accounted for by conditioning on basic demographic characteristics. The interpretation of the results of this analysis predominantly applies to a specific population of socioeconomically disadvantaged mothers residing in urban areas and does not readily extend to mothers with incarcerated partners from different backgrounds. For urban

households, and particularly unwed parents, the results of this dissertation provide important insight into understanding the challenges that family members may face when a father becomes incarcerated.

Chapter 2

The Effect of the Incarceration of Fathers on the Public Assistance Participation of Mothers

2.1 Introduction

The male incarceration rate in the U.S. has increased sharply over the last several decades. In 1980, there were approximately 300,000 men incarcerated in state or federal prison (Allen and Gilliard, 1995). As of 2009, state and federal correctional authorities had jurisdiction over 1.5 million male prisoners (West 2010). A growing number of incarcerated men are fathers. There were 744,200 incarcerated fathers in state or federal prisons in 2007, which is a 76 percent increase from the 423,000 fathers that were incarcerated in 1991. Over half of incarcerated men report having at least one minor child. Approximately a quarter of incarcerated fathers have children under 5 years old, and half have children under 9 years old (Glaze and Maruschak, 2008). The incarceration of a father can have important economic implications for the mother who shares children with the incarcerated man, particularly if the father was involved in the mother's life prior to incarceration. And, since a mother's economic wellbeing may impact the health and wellbeing of her children, the incarceration of a father may have both immediate and potentially long term impacts on children[6].

[6] A growing amount of research finds that children in economically disadvantaged families have an increased risk of poor physical health (e.g. Lu et al. 2004) and development (Duncan and Brooks-Gunn, 2000), which might have long lasting effects.

Theoretically, a father's incarceration can have negative or positive effects on the economic condition of mothers[7]. Because men from low income communities are more likely to experience incarceration, in many cases a father's incarceration may exacerbate the financial hardships already experienced by their families[8]. Families may experience financial losses or incur additional financial expenses as a result of a father's incarceration. The clearest mechanism through which incarceration may affect economic wellbeing is through the inability of the incarcerated father to contribute to the mother's household either financially or through other nonmonetary contributions such as childcare or other in-kind support. Even if the father is not present in the household, as long as he is not incarcerated, he may provide support to the mother via child support payments or through other informal contributions[9]. Most incarcerated men are unable to earn an income and those employed by the prison industry while incarcerated do not earn a sufficient amount of income to provide meaningful financial support to family members. But many incarcerated men would potentially contribute positively to the financial conditions of family members were they not incarcerated. Indeed, over 70 percent of fathers in state or federal prisons were employed during the month prior to incarceration and approximately 50 percent of incarcerated fathers earned an income of at

[7] There may also be no effect if the father is not closely connected to his family, especially in terms of providing financial support. Approximately half of incarcerated fathers in the U.S. are not married (Glaze and Maruschak, 2008). However, an analysis of unmarried parents surveyed in the Fragile Families and Child Wellbeing Study finds that many unmarried fathers provided financial support to mothers at the time of their child's birth. With respect to economic contributions, 83 percent of fathers gave money or bought things for the baby during the pregnancy and 80 percent provided in-kind support (Carlson and McLanahan, 2009).

[8] See Murray, 2005 for a review of studies on the effects of male incarceration on the family unit left behind. See also Western, 2006.

[9] For example, fathers often may assist with paying bills or assist with child care or groceries outside of formal child support orders (Edin and Lein, 1997).

least $1,000 in the month preceding arrest (Mumola 2000)[10].

The new expenses associated with father's incarceration may adversely affect the economic condition of mothers. Associated costs may include high charges for telephone calls, postage fees for letters, travel costs for visitation, attorney fees, and money sent directly to the inmate for commissary purchases[11]. Many fathers remain in contact with their children while incarcerated. Because many of the children of incarcerated fathers are in the care of their mothers, it is reasonable to believe that mothers absorb at least a portion of these additional expenses. In fact, 40 percent of fathers in state prison reported a minimum of weekly contact with their children and 62 percent reported a minimum of monthly contact (Mumola 2000).

In some cases, a partner's incarceration may temporarily improve a mother's financial circumstances. For example, if the incarcerated father abused drugs or alcohol prior to incarceration and disproportionately drained the financial resources of the mother's household in support of his substance dependency, his incarceration may improve the economic condition of the mother. The majority of incarcerated fathers in state or federal prison reported previous drug use (85 percent) and over half reported using drugs in the month before current arrest (58 percent). Additionally, one quarter of incarcerated fathers reported a history of alcohol dependence and 37 percent reported being under the influence of alcohol at the time of current offense (Mumola, 2000). Thus, it is an empirical question to measure the sign and magnitude of the effect.

[10] In a report issued by the Bureau of Justice Statistics, Mumola (2000) presents data from the 1997 Survey of Inmates in State and Federal Correctional Facilities concerning inmates with children under the age of 18. Data are collected through personal interviews with a nationally representative sample of inmates.
[11] Grinsfield et al (2001) interview women visiting male inmates at a large state prison and find that low income women spent on average 26 percent of their income on prison visits as well as other costs related to maintaining contact with incarcerated men.

This research examines whether the economic wellbeing of mothers is adversely affected by the incarceration of her child's father, hereafter referred to as her partner. Public assistance participation is used as a proxy for the economic hardship of mothers and is defined by the receipt of welfare (TANF) and food stamp (SNAP) benefits. Each outcome will be analyzed separately, which allows me to quantify the effects for each program. Eligibility for welfare and food stamp benefits is based largely on the financial needs of families. As such, participation in either of these programs is a reasonable indication of the economic hardship of mothers. Additionally, public assistance program expenditure may also be considered a component of the total cost of incarceration and it is one that has not yet been studied. The analysis utilizes data from the Fragile Families and Child Wellbeing Study (FFCWS), a national sample of mostly unwed, urban parents and their children.

Women who have children with men who become incarcerated are selectively different from mothers whose partners do not become incarcerated. For example, they tend to be socioeconomically disadvantaged, less educated, and have lower income (Murray 2005). These characteristics are also closely associated with public assistance participation. In the presence of characteristics that both potentially determine mother's public assistance participation and are correlated with whether a mother has an incarcerated partner, standard ordinary least squares estimates of the effect of partner incarceration on mothers' public assistance participation will reflect the true effect of incarceration as well as the effects of other unobserved factors that are related to a mother's partner incarceration status. Therefore, these estimates may not necessarily represent the causal effect of partner incarceration on public assistance participation.

I employ propensity score matching methods that address the non-random selection of mothers with incarcerated partners in order to estimate the average treatment effect of partner incarceration on women whose partners are incarcerated (ATET). This ATET is the difference in public assistance participation of a mother with an incarcerated partner and what her public assistance participation would have been if her partner were not incarcerated. From the perspective of causal inference, the ideal approach for estimating the counterfactual outcome would be to use a randomized experiment framework in which mothers are similar along all characteristics with the exception that partner incarceration is randomly assigned. In the absence of this type of experiment, I use matching methods to construct an appropriate comparison group. I first estimate the probability that a woman has an incarcerated partner conditional on a large set of observable characteristics. The predicted value of this regression becomes the propensity score. Mothers with incarcerated partners are then matched with comparison mothers who have similar estimated propensity scores. I then compare the public assistance outcomes of mothers who share similar underlying probabilities of having an incarcerated partner but differ in whether their partner is actually incarcerated. As I make clear in section 2.5, this allows for the identification of the causal effect of partner's incarceration on the mother's public assistance participation. I find robust evidence that, among women whose partners are incarcerated, the incarceration of that woman's partner increases the probability that she receives welfare and food stamp benefits by 13-23 percentage points, relative to what would have happened had her partner not been incarcerated.

2.2 Background on Public Assistance Programs

The Temporary Assistance to Needy Families (TANF) program was created under the welfare reform legislation of 1996–The Personal Responsibility and Work Reconciliation Act (PRWORA) – to replace the welfare program known as Aid to Families with Dependent Children (AFDC). Similar to the AFDC program, the TANF program is designed to provide financial assistance to low income families, with a primary focus on pregnant women and families with one or more dependent children[12]. The average number of TANF families in 2009 was 1.8 million with annual program expenditure of $25 billion. TANF families received an average monthly benefit amount of $372. Only 11 percent of TANF families reported cash resources (e.g. cash on hand, bank accounts) and on average amounted to $236. Additionally, fewer than one in every five TANF families had non-TANF income, with an average income $587 per family[13]. Thus, the TANF program largely serves poor families with few financial resources.

The Supplemental Nutrition Assistance Program (SNAP), formerly and commonly known as the federal Food Stamp Program, provides food assistance to low income individuals and families. The program is administered by the U.S. Department of Agriculture's Food and Nutrition Service (FNS). In 2009, SNAP assisted 33 million people living in 15 million households at a total annual cost of $53 billion. Average monthly SNAP benefits for participating households was $276. Unlike TANF, SNAP benefits are available to low income households regardless of family structure. In fact,

[12] TANF is distinguished from AFDC because it includes time-limited assistance, strong work requirements, options for noncash assistance such as child care, and a block grant financing structure (Moffitt 2002).

[13] U.S. Department of Health and Human Services, Administration for Children and Families, Office of Family Assistance, Eighth Annual Report to Congress, Temporary Assistance for Needy Families Program (TANF)

fewer than 10 percent of all SNAP households receive TANF, although 80 percent of TANF families receive SNAP assistance. Approximately 86 percent of SNAP households live in poverty; 42 percent of households had gross income less than or equal to half of the poverty line and these households receive 56 percent of all benefits. Additionally, typical SNAP households had monthly gross income of $711 per month[14]. Because TANF and SNAP participants are concentrated among poor households, participation in these programs is a reasonably proxy for the economic condition of mothers. For ease of discussion, the terms "welfare" and "TANF" will be used synonymously, as will the terms "food stamps" and "SNAP".

2.3 Related Literature

Previous research analyzing the effects of male incarceration has focused largely on ex-offenders, with particular interest in labor market[15] and health outcomes[16] of formerly incarcerated men. The rising incarceration rate of fathers has led researchers from a variety of disciplines to consider the effects of incarceration on the development and wellbeing of children[17]. There is also a growing literature analyzing the impact of male incarceration on various outcomes for women. This empirical line of research can be further divided into two categories. The first focuses on the indirect effect of aggregate incarceration rates on outcomes, and the second category focuses on the direct effect of

[14] U.S. Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis, Characteristics of Supplemental Nutrition Assistance Program Households: Fiscal Year 2009, by Joshua Leftin, Andrew Gothro, and Esa Eslami. Project Officer, Jenny Genser. Alexandria, VA: 2010

[15] Western, 2002, Pager, 2003, Freeman, 1991, Waldfagel, 1994, Lewis, Garfinkel and Gao, 2007, and Kling, 2006

[16] Schnittker, 2007, Massoglia, 2008

[17] Geller et al., 2010, Wildemen, 2010, Geller et at., 2009, Wilbur et al., 2007, and Parke and Clarke-Stewart, 2002

incarceration of individuals on outcomes of their families by assigning male incarceration directly to female outcomes. The first line of research has considered such outcomes as female employment, education, and fertility[18]. The predominant mechanism through which aggregate incarceration rates may affect female outcomes is presumed to be through the effect on the sex ratio, where the incarceration of thousands of prime aged, mostly minority men causes the sex ratio to become unbalanced in the non-incarcerated population. To address the endogeneity of incarceration, instrumental variables techniques have been commonly applied[19]. The general findings are that the male incarceration in the aggregate leads to lower fertility, and higher employment and educational attainment among women.

My analysis fits into the second strand of research that considers the direct effect of the incarceration of a male on the outcomes of a woman who has a current relationship with the incarcerated man, such as a wife or partner. Research in this area examines incarceration at the individual level, and so the most likely mechanisms by which incarceration affects female outcomes are typically household-based, such as through changes in household income or expenses. Soicher, Geller, and Garfinkel (2009) use the FFCWS to examine whether an incarceration of a father increases the extent to which their partners and children experience self-defined material hardship, which measures the extent to which families report experiencing difficulties meeting basic needs such as food, housing, and medical care. The authors use two measures of incarceration. The first is whether the father has ever been incarcerated and the second considers recent incarceration of the father. The authors' primary casual identification strategy is an

[18] Charles and Luoh, 2010, Mechoulan, 2010, and Kamdar, 2007
[19] Examples of instruments previously used are state level incarceration rates and state sentencing laws.

individual fixed effects model[20]. This method allows the examination of within-family changes in hardship in response to paternal incarceration and controls for time-variant family characteristics. One limitation of this methodology is that it may not account for relevant characteristics that may not be constant over time, such as a partner's drug or alcohol use. The authors conclude that the incarceration of a father indeed increases hardship for families.

Closely related to this research, Sugie (2011) uses data from the Fragile Families and Child Wellbeing to examine the relationship between recent paternal incarceration and families' receipt of TANF, food stamps, and Medicaid/SCHIP. Using logit and fixed-effects logit models, the results indicate that incarceration does not increase the likelihood of TANF receipt but significantly increases food stamps and Medicaid/SCHIP receipt. The family studies literature has also conducted qualitative analysis on this topic. Ardittie et al. (2003) interview family members visiting incarcerated individuals at a local jail, in which most of the participants were visiting boyfriends or husbands with whom they shared small children. Families reported significant loss of economic stability due to incarceration. This was driven by the loss of income provided by incarcerated fathers, loss or unavailability of child support, and new expenses associated with incarceration, including the sharing of scarce financial resources with the inmate. Three fourths of participants reported sending money to the inmate and participants who shared biological children with the inmate spent an average of $59 per month. Among all participants, more than half (53.5%) were on public assistance, and 72% began receiving public assistance during the family member's incarceration. The authors also note that a

[20] The authors also use propensity score analysis as a sensitivity analysis, but the model specification is not explained in detail.

contributing factor to the need for welfare benefits was due to the tendency of mothers to leave the paid labor force, in many cases due to the other parent's unavailability to help support with the care of the child[21].

2.4 Data

2.4.1 Fragile Families and Child Well-being Study

This analysis uses data from the Fragile Families and Child Wellbeing Study (FFCWS), a longitudinal study of mostly unwed parents and their children. The sample was selected in a three stage sampling procedure which involved first sampling cities based on welfare generosity, the strength of the child support system, and the strength of the local labor market. Hospitals within cities were then sampled to be representative of non-marital births in each city, followed by sampling of births within each hospital[22]. The study was conducted in 20 large U.S. cities[23] with populations of 200,000 or higher and has an oversample of unmarried parents. The total samples size is approximately 4,700 families, including 3,600 unwed couples and a comparison group of 1,100 married couples. Baseline interviews took place between 1998 and 2000. Mothers, and fathers if available, were initially interviewed at hospitals within a few days of their child's birth. Fathers who were not present at the hospital were interviewed elsewhere soon after the child left the hospital. Follow-up interviews were conducted when the children were 1, 3, and 5 years old.

[21] It should be noted that most of the participants resided with the inmate before incarceration, so the results are not directly applicable to mothers who did not live with the incarcerated partner.
[22] See Reichman (2001) for more information on the survey design
[23] The cities represented in the survey are Austin (TX), Baltimore (MD), Boston (MA), Chicago (IL), Corpus Christi (TX), Detroit (MI), Indianapolis (IN), Jacksonville (FL), Milwaukee (WI), Nashville (TN), Newark (NJ), New York (NY), Norfolk (VA), Oakland (CA), Philadelphia (PA), Pittsburgh (PA), Richmond (VA), San Antonio (TX), San Jose (CA), and Toledo (OH).

The design of the FFCWS has several benefits for examining the relationship between fathers' incarceration and mothers' public assistance participation. Mothers provide information on the capabilities and experiences of fathers who were not available for interview. This proves to be important, given that only about 75% of fathers were interviewed at the baseline survey period. The FFCWS also provides a direct assignment of father's incarceration status to the economic outcomes of the mother, which allows me to estimate the direct effect of incarceration on TANF and SNAP participation. Detailed information has been reported on family characteristics, employment, and use of government assistance programs. There is also data on parents' behavior, capabilities and household conditions (such as drug use and access to financial support from family members), that are typically unobserved in household surveys. The availability of such a rich set of observable characteristics of both parents is critical for the proper application of matching procedures.

2.4.2 Measures

Current incarceration status is considered at two points in time: at the one year and the three year survey periods. The incarceration status of the father is derived from a combination of the mother's report of the father's incarceration status and father's report of his own status. If either the father or mother report that the father is incarcerated at the time of interview, either directly or indirectly, he is considered as currently incarcerated.

The outcome of interest is the mother's public assistance participation at the one year and three year follow-up survey periods. Public assistance participation is defined separately by welfare and food stamp program participation. The measure of welfare

participation is based on mothers' self reports of whether they received welfare benefits in the twelve months prior to the interview. Food stamp participation is defined in a similar manner. One caveat is that, since the timing of public assistance participation can be reported for up to a year prior to the interview and incarceration status is potentially measured more recently, timing of participation may not accurately correspond to the timing of father's current incarceration However, the vast majority of mothers who reported receiving welfare and food stamp benefits within the year prior to the interview also reported receiving a positive amount of benefits during the month prior to the interview, implying that participation is relatively current at the time of interview.

2.4.3 Summary Statistics

Mean characteristics for the baseline sample are presented in the first column of Table 2.1. These statistics are presented to give an overview of the basic demographic characteristics of parents in the initial sample. The only sample restriction for the baseline sample is that parents younger than 18 years old are excluded[24].

Over 70 percent of the sample is minority; approximately 45 percent of couples are Black and 27 percent Hispanic. Only about 20 percent of couples are White and 15 percent of the couples are interracial. Mothers in the sample are, on average, 25 years old upon entering the survey. Fathers are older than mothers on average, with a mean age of 28 years. Mothers and fathers have an average of 2.2 children and 30 percent have less

[24]Minors are excluded for two reasons. First, educational attainment at baseline is defined by high school completion. Minors may not have the opportunity to complete high school, which is typically accomplished by age 18. Second, the outcome of interest is public assistance participation of mothers, which is used as a proxy for mothers' economic wellbeing and ability to sustain a household. Minors are more likely to live with parents and to not live independently.

than a high school education. Only 25 percent of the couples are married, and 37 percent of unwed couples cohabit.

A common concern when working with panel data is the potential of selective attrition, where individuals who leave the study may be characteristically different from those who do not. Response rates for adult mothers were 89 percent for the year 1 interview and 87 for the year 3 interview. The last three columns of Table 2.1 present mean characteristics for mothers who leave the study and mothers who remain in the study. Hispanic mothers are more likely to leave the study than Black and White mothers. In the initial baseline sample, 27 percent of mothers are Hispanic. Among the mothers who do not participate in the year 1 and year 3 follow-up studies, 32 percent and 35 percent, respectively, are Hispanic. Additionally, mothers with less than a high school education and mothers with a higher number of children on average are more likely to attrit. In the baseline and follow-up samples, about 32 percent of mothers do not have a high school education and the average number of children is 2.2. Among mothers who leave the study, 40 percent have not completed high school and the average number of children is 2.4. Although there appear to be small differences between mothers who leave and remain in each follow-up period, the mean characteristics of mothers who remain in the study are overall relatively similar to the characteristics of the baseline sample, so that selective attrition is not a big concern.

2.5 Empirical Methodology

2.5.1 Matching Conceptual Framework

Define treatment as a mother having a newly incarcerated partner between the baseline and year 1 interview, excluding men incarcerated at baseline[25]. Let D_i=1 if a mother is in the treatment group and 0 otherwise. Y_{i1} represents the public assistance participation for mother i if treated and Y_{i0} if untreated. Given the likely heterogeneity of treatment responses across individuals, there are two types of treatment effects that are typically evaluated. The first is the effect of treatment on an individual drawn randomly from the sample, or the average treatment effect (ATE). The second is the effect of treatment on individuals who are in the treatment group, or the average treatment effect on the treated (ATET). The ATE may not be insightful in estimating the effect of partner incarceration if many women in the untreated group are unlikely to experience the incarceration of their partner. The more interesting question is the effect for women whose partners are actually incarcerated. Therefore, my goal with using matching methods is to estimate the average treatment effect on the treated (ATET), which is the effect of partner incarceration on mothers whose partners are incarcerated. The ATET can expressed by the following:

$$ATET = E[Y_{i1}-Y_{i0}|D_i=1] = E[Y_{i1}|D_i=1] - E[Y_{i0}|D_i=1] \qquad (1)$$

which is the difference between a mother's public assistance participation outcome if she is in the treatment group and her potential outcome if she were not in the treatment group. As it relates to this analysis, this equation represents the difference in public assistance

[25] This discussion is drawn from Ham, Li, and Reagan (2009), Rosenbaum and Rubin (1983), Heckman (1998), Dehejia and Wahba (2002), Caliendo & Kopeinig (2005), and Bryson, Dorsett, and Purdon (2002)

participation of a mother with an incarcerated partner and what her public assistance participation would have been if her partner were not incarcerated.

The first term, $E[Y_{i1}|D_i=1]$ can be estimated since the public participation outcomes for women with incarcerated partners is observed in the data. However, the second term, $E[Y_{i0}|D_i=1]$ is not observable. This term represents what mother's public assistance participation would have been if her partner had not been incarcerated. It is clearly impossible to go back in time and change the mother's partner incarceration status and observe her public participation decision. To estimate it, instead, one must use the outcomes of mothers in the sample whose partners are not incarcerated (mothers in the untreated group) in order to obtain information to infer the counterfactual outcome. And while randomized trials are the gold standard for evaluation, randomizing an individual's incarceration status is impractical if not immoral[26]. Without random assignment, the counterfactual cannot be immediately inferred directly from outcomes of women in the untreated group, as they are likely to differ along both observable and unobservable characteristics from women in the treated group. Matching methods will choose a comparison group of women who are very similar to women in the treated group in order to construct the counterfactual outcomes of the treated had they not received treatment. In other words, matching estimators are used to replicate the condition of an experiment by choosing an appropriate comparison group from untreated women such that the selected women in the comparison group are as similar as possible to the treated group along observable characteristics and partner incarceration status can be considered a

[26] There are studies, however, that have used randomized experimental designs in correctional system programs (MacKenzie, 2006) and policing approaches (Weisburt, 2005 and Sherman, Schmidt, and Rogan, 1992).

random event[27].

The process of constructing counterfactual outcomes also explains why it is more appropriate to estimate the ATET rather than the ATE for this data sample. The ATET is estimated by using untreated units to construct an appropriate counterfactual for treated units. This sample contains a substantially larger amount of untreated units relative to treated units. Therefore, there are many comparison units that can be used to construct a suitable group of comparison that are similar along observable characteristics of the treated group. Estimating the ATE, however, requires using matching methods to estimate the public assistance participation of women without incarcerated partners had their partners become incarcerated. Constructing a suitable counterfactual for a large group of untreated units using a relatively small number of treated units as in this sample would likely produce estimates so noisy as to not be of use.

An identifying assumption for matching is the conditional independence assumption (CIA): $Y_{i0}, Y_{i1} \perp\!\!\!\perp D_i|Z$. However, for estimating the ATET, the only requirement is that $Y_{i0} \perp\!\!\!\perp D_i|Z$. This condition states that, conditional on observable characteristics Z, the distribution of potential outcome of the treated in the absence of treatment is the same as the outcome distribution of the comparison group. Conditional on Z, this allows the counterfactual outcome for the treatment group to be inferred from the outcomes of the comparison group, and therefore any differences between the two groups can be attributed to treatment. Thus, under the CIA, the matching process is analogous to replicating an experimental design in that, conditional on observed characteristics Z, the selection into treatment can be considered random. However, for the condition to be credible, it is necessary to utilize to a rich dataset in order to

[27] For example, this could occur if there is randomization in police arrest rates or sentencing by judges.

incorporate a suitable amount of relevant variables that affect both treatment and the outcome variables. The FFCWS is particularly well suited to employing matching techniques because it contains detailed variables that determine both partner incarceration status and public assistance participation that are typically unobserved in household surveys.

Another identifying assumption for estimating the ATET is the common support condition: $P(D=1|Z)<1$[28]. This condition requires a positive probability of observing untreated units at each level of Z, and therefore ensures the availability of suitable comparison units to match with each treated observation. Given the large number of untreated units relative to the number of treated units, this constraint is not a problem in my data.

2.5.2 Propensity Score Matching

Matching on Z can be problematic with a large number of observable characteristics and observation. Rosenbaum and Rubin (1983) introduce the propensity score, which is defined as the conditional probability of treatment given a vector of observed characteristics Z: $Prob(D_i=1|Z)$. They show that, by definition, the treated and untreated observations with the same value of the propensity score have the same distribution of Z: $Z \perp\!\!\!\perp D_i|p(Z)$. It follows that if the potential outcomes are independent of treatment conditional on Z, then this is also true conditional on the propensity score: $Y_{i0} \perp\!\!\!\perp D_i|p(Z)$. Therefore, rather than matching on a vector of covariates Z, it is possible to

[28] For estimating ATE, the additional assumption, $P(D=1|Z)>0$, is required.

match instead on just the propensity score, reducing the dimensionality problem to a single index.

The propensity score is defined as the probability that a mother has an incarcerated partner, conditionally on observed characteristics Z. In this context, the propensity score is estimated using a probit model. Covariates in the propensity model are observed characteristics that affect both the propensity for having an incarcerated partner and public assistance participation. These variables should not be influenced by treatment, and should be measured prior to treatment or fixed over time. (Caliendo & Kopeinig, 2005) Treatment is defined as having a partner that is newly incarcerated between the baseline and year 1 survey period[29]. This treatment definition excludes women whose partners are incarcerated at baseline, which allows conditioning variables observed at the baseline period to be included in the propensity model.

Covariates included in the propensity model include basic demographic characteristics of the parents and further detailed information on the behavior and capabilities of both parents. Choice of variables is informed by previous research on the determinants of public assistance participation and incarceration. Variables that are key determinants of the incarceration of men are race, education, and drug and alcohol use. I therefore include this information in the model about the father as reported by the mother. Because there appears to be positive assortative mating of couples in this sample, I also include similar information on mother's age, education, race, and behavior. Many characteristics associated with having incarcerated partner are also correlated with public assistance participation; therefore the variables listed above are also relevant to the propensity to receive public assistance benefits. In addition to the variables above, I also

[29] Alternative definitions of treatment will also be considered in the section 6.

include additional variables that are associated with public assistance participation, including mother's access to financial support from family and employment status.

Matching estimators are based on the strategy of matching treated observation units with comparison units based on the estimated propensity score. Estimators differ in the weighting schemes given to counterfactual outcomes. Among the most widely used matching estimators are nearest neighbor and kernel matching functions. The application of the bootstrap to obtain standard errors is widely applied by researchers utilizing matching methods, although it has not been formally justified in the literature. One caveat of using bootstrapping is that it is generally not valid for nearest-neighbor matching estimators with replacement and fixed number of neighbors. As shown by Abadie and Imbens (2008), the standard bootstrap fails to provide asymptotically valid standard errors. I will therefore focus exclusively on kernel matching procedures[30].

Kernel matching estimators match treated observations with a weighted average of comparison observations with weights that are inversely proportional to the distance between the propensity scores of the treated and comparison units. Kernel functions differ in how weights are assigned to comparison units. In this study, I consider the Epanechinikov and Tricube kernels. Under both of these weighting schemes, treated units are matched only with comparison units whose propensity scores fall within a predefined neighborhood, or bandwidth. Comparison units that have propensity scores that are closer to that of the treated unit within the bandwidth receive higher weight, while comparison units outside of the bandwidth receive zero weight. This ensures that

[30] Ham, Li, and Reagan (2010) do a Monte Carlo experiment to see how well the bootstrap does in calculating standard errors for local linear regression matching estimators. They find it does an excellent job; given the similarity between local linear regression matching and kernel matching, one would expect their results to also apply to kernel matching.

treated units are matched units with comparison units that have similar observed characteristics. The balancing condition states that the distribution of covariates Z are similar across the treated and matched comparison groups. For matching to be effective, characteristics should be balanced across both groups. After conditioning on the propensity score, the probability of assignment into treatment should be independent of covariates Z.

2.6 Empirical Results

2.6.1 OLS Model

A first step in analyzing the effect of partner incarceration is to compare the mean of public assistance participation for mothers with incarcerated partners to the respective mean for mothers whose partners are not incarcerated. The problem with this simple comparison of means is that mothers with incarcerated partners may be very different from other mothers in the sample. To investigate the pre-existing differences between women whose partners are incarcerated and those whose partners are not incarcerated, Table 2.2 presents the mean demographic characteristics for mothers in the year 1 follow-up sample by partner incarceration status. By comparing mean characteristics of both groups of mothers, we can see that there are statistically significant differences in observable characteristics such as race, age, and educational attainment. Overall, women with incarcerated partners are less likely to have a high school education and are more likely to have partners that are Black or Hispanic and without a high school education.

The obvious next step would be to estimate an OLS equation for program participation which conditions on the demographic variables in Table 2.2. That is, one estimates a regression equation of the form

$$Y_{it} = \alpha + \beta I_{it} + \gamma X_i + \varepsilon_{it} \qquad (2)$$

where Y_{it} is a dummy variable coded 1 if the mother receives public assistance[31] in the year 1 follow-up period[32] and 0 otherwise; X_i is a vector of basic demographic characteristics measured at the baseline period, including parent's race, age, education, and city of residence; and I_{it} is a binary variable equal to 1 if the mother's partner is recently incarcerated at the year 1 follow-up period (excluding partners incarcerated at baseline) and 0 otherwise. Finally, unobservables affecting Y_{it} are captured in ε_{it}, If X_i and I_{it} are uncorrelated with ε_{it} the estimate of β will estimate the causal effect of interest.

Table 2.3 reports the OLS estimates of the effect of partner incarceration on the public assistance participation of mothers. Columns 1 and 3 display the unadjusted mean estimates of the effect of partner incarceration on welfare and food stamp program participation, respectively. This essentially represents the unconditional differences in public assistance participation for women with and without incarcerated partners. On average, women with incarcerated partners are 27.4 percentage points more likely to receive welfare and 29.1 percentage points more likely to receive food stamps than women whose partners are not incarcerated. Columns 2 and 4 present results of the adjusted OLS model which controls for basic demographic characteristics X. Once

[31] Recall that public assistance participation is measured by two outcomes: welfare program participation and food stamp program participation.
[32] I begin by analyzing the year 1 sample; the year 3 sample will be considered in section 6.4.

demographic control variables X are added to the model represented by columns 2 and 4, the effect of incarceration remains positive and statistically significant, but the coefficient on partner incarceration is reduced to 16 percentage points for welfare participation and 15 percentage points for food stamps participation. The reduction in magnitude of the estimates from the unadjusted to the adjusted models indicates that differences in basic demographic characteristics partially explain the public participation differences between women with and without incarcerated partners.

The covariates in the OLS adjusted model influence both participation outcomes in the same direction, with the exception that having a partner of a different race decreases welfare participation and increases food stamps participation. The partner's race and ethnicity has a larger effect on food stamps participation than welfare, as does mother and partner's educational attainment. However, all of the covariates are statistically significant for both participation outcomes, with the exception of couples being of different race and partner's age. Certain characteristics that are correlated with public assistance participation also appear to be correlated in the same direction with partner incarceration status. As Table 2.2 reports, women with incarcerated partners are more likely to be less educated and have partners that are Black and have less than a high school education. This suggests an upward selection bias, which may further suggest selection on unobservables conditional on basic demographic characteristics.

Since mothers with incarcerated partners differ from those without incarcerated partners in terms of observables, it is also likely they differ in terms of unobservables. In this case the correlation of I_{it} with the error term causes the estimate of β from (2) to be a biased estimate of the causal effect of incarceration on public assistance participation. To

obtain a consistent estimate of this causal effect, such selection must be accounted for. To do this I employ propensity score match (PSM) techniques. In matching methods, mothers with and without incarcerated partners are matched based on the estimated propensity score, resulting in the comparison of women with similar observable characteristics who differ only in whether their partner is incarcerated. The propensity model conditions on a large set of observable characteristics that allows the conditional independence assumption to be satisfied and eliminates the selection bias. Differences in outcomes can therefore be attributed to the incarceration of the partner. Advantages of PSM as compared to OLS estimation are that PSM does not impose a linear functional form and it also allows for the inclusion of a wider set of conditionally variables that are typically not included in OLS estimation.

2.6.2 Propensity Score Model and Balancing Test

Table 2.4 presents the probit estimates of the propensity score. Compared to women

whose partners are not incarcerated, women with incarcerated partners are significantly more likely to be younger and less education, and have more children; and the partners are more likely to be Black and have less than a high school education. The probability of partner incarceration also increases with mother and partner's drug use, the length of time the mother knew her partners, and whether the partner supported mother during pregnancy. [33]

Among non-treated observations, the predicted probability of having an incarcerated partner ranges from 9.7E-6 to 0.4278. Among treated observations, the

[33] The model also includes dummy variables for city of residence

predicted probability ranges from 0.0053 to 0.4608. Within the range of 9.7E-6 and 0.0053 there are comparison units with propensity scores that are substantially lower than that of the minimum of the treated units. Mothers with propensity scores in this range have very low probabilities of having an incarcerated partner and differ substantial in observable characteristics from mothers in the treated group. I therefore enforce common support at the lower extreme of the propensity score distribution and exclude mothers with propensity scores that are lower than the minimum of the treated group. This results in the exclusion of 954 comparison units from the matched sample.

Table 2.5 presents results of the balancing tests of the null hypothesis that the mean of each characteristic is equal between the treated and comparison groups. This ensures that, on average, the mothers in each group have similar observable characteristics. If the balancing test fails, interaction and higher order terms are added to the propensity model until the balancing property is satisfied. The results of the paired t-tests indicate that the covariate means between the treated and comparison units are not statistically different, and the balancing condition is satisfied.

2.6.3 Propensity Score Matching Estimates

Table 2.6 reports the OLS and propensity score matching estimates of the effect of partner incarceration on the public assistance participation of mothers. Panel 1 repeats the OLS estimated coefficients for partner incarceration that were reported in Table 2.3. Panel 2 reports OLS and propensity score matching results for the smaller sample restricted to the region of common support, which will hereafter be referred to as the matched sample. As discussed above, restricting the sample to the region of common

support excludes mothers who have a very low probability of having an incarcerated partner. The unrestricted sample corresponding to panel 1 will be referred to as the full sample. The average rate of participation for each outcome is reported for the corresponding samples in columns 1 and 4. Columns 2 and 5 present the unadjusted mean differences in public assistance participation between the treatment and comparison groups (i.e. OLS regression without any controls). Columns 3 and 6 report the adjusted OLS results that control for basic demographic characteristics[34], which represent the conditional mean outcome differences. The distinction between the OLS models of each panel is that the results of panel 2 are estimated for the restricted, smaller matched sample.

There are several things to note in comparing the mean outcomes and OLS estimates for each sample. As reported in column 1, 22.8 percent of all mothers in the full sample receive welfare benefits and 35.8 percent receive food stamp benefits. The average participation rates for the matched sample are 5 percentage points higher for welfare participation and 7.5 percentage points higher for food stamp participation than in the full sample, as shown in column 4. As discussed previously, certain observable characteristics that determine whether a mother has an incarcerated partner are also correlated in the same direction as public assistance participation. The matched sample therefore not only includes mothers who have higher propensities of having an incarcerated partner, but also mothers who are more likely to receive public assistance. This results in a larger mean public assistance rate for mothers in the matched sample. A

[34] Demographic control variables are parent's race, age, and education.

similar explanation applies to the reasoning behind the lower unadjusted mean differences in public assistance participation between the treatment and comparison groups for the matched sample (presented in column 2) than for the full sample (presented in column 5). The unadjusted mean difference is 6 percentage points lower in the matched sample for welfare participation and 8 percentage points lower for food stamp participation. By eliminating mothers who are less likely to have an incarcerated partner by imposing common support, the comparison units in the matched sample are also potentially more likely to receive public assistance. The difference in mean welfare and food stamp program participation between the treated and comparison units of the matched sample is therefore smaller than in the full sample. Once conditioning on basic demographic characteristics, however, the adjusted OLS estimates for the matches sample are only slightly lower in magnitude than that for the full sample. As columns 3 and 6 report, the adjusted mean difference in welfare participation is nearly 1 percentage point higher for the matched sample and only 0.5 percentage points higher for food stamp participation.

I will now discuss the OLS and propensity score matching results of the matched sample restricted to the region of common support as reported in panel 2 of Table 2.6. Because propensity score matching addresses the issue of selection bias, the matching estimates are the main results of this analysis. On average, when I do not control for any demographic factors as presented in column 5, women with incarcerated partners are 21.4 percentage points more likely to receive welfare and 21.0 percentage points more likely to receive food stamps. Both coefficients are significant at the 1 percent level. After controlling for basic demographic characteristics in column 6, the effect remains positive

and statistically significant, but the magnitude is reduced to 15.1 and 14.5 percentage points for welfare and food stamps, respectively.

The OLS regression model identifies the incarceration effect by comparing the average outcome of mothers with and without incarceration partners (ATE) after controlling for demographic differences. While matching estimates confirm the direction of the incarceration effect implied by the OLS results, matching methods are used to answer a narrower question, which is the effect of incarceration on the actual women whose partners are incarcerated (ATET). OLS regression models use all untreated mothers in the sample as comparison units, while propensity score matching uses only women who are similar in observable characteristics to women in the treated group as counterfactual outcomes, which allows me to consistently estimate the ATET. Propensity score matching estimates are reported in columns 7 and 8 respectively for the Epanechinikov and Tricube kernel functions using a bandwidth of 0.15 These matching estimates suggest that, for women whose partners are incarcerated, the incarceration of a partner significantly increases the probability that mothers receive welfare by 15-17 percentage points and food stamps by 15-16 percentage points, relative to the case where the mother had not experienced the incarceration of a partner. All coefficients are significant at the 1 percent level. This represents a substantial increase of over 50 percent from mean welfare participation and a 35 percent increase for food stamp participation. The results in Table 2.7 suggest that the matching estimates are fairly robust to the selection of kernel function, and the public assistance outcome estimates range from 12-18 percentage points.

Interestingly, the matching estimates are qualitatively similar to the adjusted OLS estimates for the full and matched samples. This suggests that selection bias may be largely attributed to selection on basic demographic characteristics. For this specially selected sample of urban, mostly unmarried mothers, once basic demographics are accounted for incarceration can be considered somewhat of an exogenous event, affecting all mothers in the sample in a similar manner. It is important to note that this interpretation does not readily extend to a random sample of all mothers in the US. These results apply to a specific category of mostly unmarried, disadvantaged mothers living in large urban areas.

2.6.4 Alternative Treatment Effects

An alternative way to define treatment for the year 1 sample is a dummy variable coded one if the mother's partner was incarcerated at year 1. Note that this definition will increase the size of the treatment group, since it will include partners incarcerated at baseline. The definition of treatment has implications for the choice of variables to be included in the specification of the propensity model. As discussed previously, variables that may be influenced by treatment can not be included in the propensity model. Including women in the treatment group with partners incarcerated at baseline limits the baseline variables that can be included in the propensity model. Many of the variables used in the propensity model associated with the original treatment definition excluding men incarcerated at baseline cannot be included in the propensity model corresponding to this alternative definition of treatment. For example, mother's alcohol use cannot be included in this propensity score model specification because it is possible that a mother

may resort to alcohol use due to the stress caused by her partner's incarceration. Correspondingly, many of the variables used in the previous model can no longer be assumed independent of treatment. The variables included in the propensity model under this alternative definition of treatment are the basic demographic characteristics that included in the OLS models along with two additional variables used in the first propensity model that are assumed to be independent of incarceration at the baseline: whether the mother has both parents present at age 15 and whether the mother can depend on family for financial support.

Table 2.8 presents the OLS and matching estimates of the effect of partner incarceration on public assistance participation for the full sample and matched sample. Treatment is now defined as having a partner that is incarcerated in year 1 which may also include incarcerated at baseline. Panel 1 reports the OLS results for the full sample that is not restricted by common support, while panel 2 reports OLS and propensity score matching results for the matched sample that excludes observations that are not in the region of common support, and thus have lower propensities for having an incarcerated partner. The balancing test is also satisfied for this specification and the results of the test are presented in Appendix Table 2.1.

The results are fairly consistent with the previous model in the sense that the OLS adjusted estimates are smaller than the unadjusted estimates, implying that basic demographic coefficients are important determinants of public assistance participation. The OLS estimates for both samples also become nearly identical once control variables are added to the model.

The matching estimates are slightly higher than the OLS adjusted estimates, but the matching estimates should be interpreted with caution since the model does not fully utilize the advantage of matching due to the limitation in the number of covariates. Overall, the results suggest that partner incarceration does have a positive effect on mother's public assistance participation and the effect is not necessarily limited to recent incarceration.

I now present results of recent partner incarceration on welfare and public assistance participation in year 3. Treatment is now defined as newly incarcerated in year 3, excluding men incarcerated at baseline and year 1. I am therefore estimating a new treatment effect on a new group of women with incarcerated partners. I construct two separate propensity models to estimate the year 3 treatment effects. Both models have the identical definition of treatment, but differ in the conditional variables of the propensity model. The first model includes the full set of covariates measured at baseline identical to the model for recently incarcerated at year 1 as discussed above and the results using this model are presented in the first panel. The second model includes additional covariates that are measured at year 1 and the results for this model are presented in panel 2. Because the treatment definition excludes partners incarcerated at year 1, variables measured at year 1 can be considered independent of treatment. The additional variables included in this model are mother's mental health, age at first birth, whether the mother breastfed, worked since the child's birth, access to loans, and whether the mother has a bank account or credit card. The OLS adjusted models only controls for basic demographic characteristics. The balancing test is satisfied for both models and the results of the test are presented in Appendix Tables 2.2 and 2.3.

There are reasons to believe ex-ante that the treatment effects for the year 3 sample may be different from the results of the previous analysis of the year 1 sample. In addition to the fact that parents and children are older, and the economy is different, the results will potentially differ in part because the treatment group has changed and I am estimating the effect of treatment on the treated. However, the results are fairly consistent with the previous analysis of the year 1 treatment effects. The effect of partner incarceration on welfare participation is nearly identical to that of food stamps participation once controlling for basic demographic characteristics. The OLS and matching results appear to be relatively similar even with this new treatment group. Among mothers with incarcerated partners, incarceration increases the probability that mothers receive welfare and food stamp benefits by 13-14 percentage points. Most striking is the fact that, when an additional set of rich covariates are added to the propensity model as in panel 2, the matching results are still qualitatively similar to the OLS adjusted results. This further supports the conclusion that the selection bias may be largely attributed to selection on basic demographic characteristics.

I repeat the analysis for the year 5 sample and present the results in Table 2.10. Treatment is defined as recently incarcerated in year 5, excluding men incarcerated at baseline, year 1, or year 3. There are 88 mothers in this treatment group; 70 of the women in this group receive food stamps and 35 receive welfare benefits. Similar to the analysis of the year 3 sample, I construct two propensity models that differ in the conditional variables used. The first model includes variables measured at baseline only, and is the same set of variables in the previous analysis. The second model includes variables measured at baseline as in the previous model, in addition to variables measured

in year 1 and year 3. The variables in this model are similar to the 2nd model for year 3, but some of the variables are updated for year 3. The variables age at first birth and whether the mother breastfed are measured at year 1, while mother's mental health, whether the mother worked since child's birth, has access to a cosigner, has access to loans of $200 and $1,000 and whether the mother has a bank account or credit card. The adjusted OLS model controls for only basic characteristics. The matching results are similar to the OLS results as in previous years. However, the coefficients on food stamp participation are about 10 percentage points larger than the coefficients for welfare participation. Results suggest that incarceration significantly increases the probability that mothers receive welfare and by 19-20 percentage points and food stamp benefits by 30-31 percentage points.

2.7 Conclusion

Using a sample of mostly unwed parents in large U.S. cities, this paper estimates the causal effect of fathers' incarceration on the public assistance participation of the mothers with whom they share children. I use propensity score matching methods to account for the issue of selection among women with incarcerated partners. This empirical strategy involves comparing public assistance outcomes between mothers who share similar observable characteristics but differ only in whether their partner is incarcerated. I find robust evidence that, among mothers with incarcerated partners, the incarceration of fathers increases the probability that mothers receive both types of public assistance by 13-23 percentage points. I also find that the ordinary least squares model conditioned on basic demographic characteristics are qualitatively similar to matching

estimates which condition on an extended set of observable characteristics. This implies that, for this specifically selected sample of mostly unwed mothers, selection bias appears to be accounted for by conditioning on basic demographic characteristics.

There are high costs associated with incarceration. The average operating cost per state or federal inmate is over $22,000 per year (Stephan, 2001). These explicit costs do not consider the additional 'hidden' costs that may result from the increase in public assistance participation by the mothers of the children of incarcerated fathers. This additional state expenditure can be considered as an additional component of the total cost of incarceration, particularly since my results suggest that a father's incarceration increases the probability of a mother receiving public assistance benefits. Further, these results are robust to considering different treatment effects and treatment groups.

For mothers with incarcerated partners in the Fragile Family study, the average monthly welfare benefit is $360 and the average food stamps benefit is $285[35]. This translates to an annual benefit amount of $4,320 for welfare and $3,420 for food stamps. The results of this paper suggest that incarceration increases the probability of public assistance participation by 13-23 percentage points. One way to quantify this effect is to consider, if probability of receiving public assistance is increased by 0.15, for example, the expected average annual additional cost of incarceration due to increased benefits from both programs is $1,161.

The interpretation of the results of this analysis predominantly applies to a specific population of socioeconomically disadvantaged mothers residing in urban areas and does not readily extend to mothers with incarcerated partners from different backgrounds. For urban households, and particularly unwed parents, the results of this

[35] This is a low estimate since it does not include administration costs for both programs.

study provide important insight into understanding the economic challenges that family member may face when a father becomes incarcerated.

Table 2.1: Mean Characteristics of Baseline Sample and Survey Attrition Analysis

		Attrition Analysis			
	Baseline Sample	Year 1 Interview		Year 3 Interview	
		Y1 Leavers	Y1 Stayers	Y3 Leavers	Y3 Stayers
Variable	**Mean**	**Mean**	**Mean**	**Mean**	**Mean**
Mom Black	0.471	0.465	0.472	0.435	0.477
Mom Hispanic	0.272	0.315	0.267	0.349	0.260
Mom White	0.216	0.164	0.222	0.164	0.224
Mom Other	0.041	0.055	0.039	0.052	0.039
Partner & Mom diff. Race	0.151	0.166	0.149	0.166	0.149
Mom Foreign born	0.172	0.263	0.161	0.280	0.156
Mom Age	25.564	26.376	25.465	25.894	25.513
Mom < HS Education	0.329	0.404	0.320	0.407	0.317
Mom Number Kids	2.194	2.400	2.169	2.398	2.163
Partner Black	0.489	0.493	0.489	0.452	0.495
Partner Hispanic	0.278	0.319	0.273	0.345	0.267
Partner White	0.188	0.129	0.196	0.135	0.197
Partner Other	0.045	0.059	0.043	0.068	0.041
Partner Foreign born	0.146	0.158	0.144	0.182	0.140
Partner Age	28.303	29.800	28.121	29.156	28.172
Partner< HS Edcuation	0.302	0.335	0.298	0.351	0.295
Partner Number Kids	1.890	1.721	1.910	1.786	1.906
Married	0.253	0.228	0.256	0.217	0.258
Cohabiting	0.372	0.373	0.372	0.393	0.369
No. of Observations	4665	505	4160	621	4044

Table 2.2 : Mean Characteristics of Year 1 Sample by Incarceration Status and Paired t-test of Equality of Means

	Partner Incarcerated	Partner Not Incarcerated	Paired t-statistics
Public Assistance Participation			
Welfare	0.490	0.217	-8.071
Food Stamps	0.637	0.346	-7.497
Demograpahic Characteristics			
Partner Black	0.694	0.468	-5.575
Partner Hispanic	0.210	0.279	1.890
Partner Other	0.038	0.044	0.365
Partner & Mom diff. Race	0.121	0.150	1.007
Mom Age	22.949	25.683	5.657
Partner Age	26.083	28.284	3.792
Mom Foreign born	0.057	0.170	3.728
Partner Foreign born	0.032	0.158	4.300
Mom < HS Education	0.510	0.302	-5.515
Partner< HS Education	0.465	0.284	-4.895
No. of observations	157	3587	

Table 2.3: OLS Results
Dependent Variable: Public Assistance Participation of Mothers in Year 1
(Partner incarcerated is defined as recently incarcerated at year 1, excluding baseline incarceration)

Dependent Variable:	*Welfare*	*Mean: 0.228*	*Food stamps*	*Mean: 0.358*
	Unadjusted	Adjusted	Unadjusted	Adjusted
	1	2	3	4
Partner Incarcerated	0.274***	0.160***	0.291***	0.150***
	(0.029)	(0.030)	(0.032)	(0.037)
Partner Black		0.175***		0.271***
		(0.025)		(0.021)
Partner Hispanic		0.047**		0.124***
		(0.020)		(0.018)
Partner Other		0.149***		0.197***
		(0.038)		(0.055)
Partner & Mom diff. Race		-0.015		0.008
		(0.017)		(0.021)
Mom Age		-0.005***		-0.003**
		(0.002)		(0.001)
Partner Age		-0.001		-0.002
		(0.002)		(0.001)
Mom Foreign born		-0.121***		-0.129***
		(0.023)		(0.036)
Partner Foreign born		-0.083***		-0.053*
		(0.029)		(0.029)
Mom < HS Education		0.150***		0.185***
		(0.023)		(0.023)
Partner< HS Education		0.068***		0.098***
		(0.019)		(0.017)
City Dummies		Yes		Yes
No. of observations	3744	3744	3744	3744

Notes: Standard errors are clustered by city of residence and are included in parentheses.
*** p<0.01, ** p<0.05, *p<0.1

Table 2.4: Probit Estimates of the Propensity Score
Dependent Variable: Partner Recently Incarcerated in Year 1

Covariate	
Partner Black	0.427***
	(0.161)
Partner Hispanic	0.362*
	(0.191)
Partner Other	0.570***
	(0.181)
Partner & Mom diff. Race	-0.181
	(0.118)
Mom Age	-0.049***
	(0.008)
Partner Age	0.007
	(0.005)
Mom Foreign born	-0.060
	(0.138)
Partner Foreign born	-0.617***
	(0.237)
Mom < HS Education	0.108
	(0.117)
Partner< HS Education	0.260***
	(0.090)
Mom lived with both parents at age 15	-0.031
	(0.094)
Mom access to family support	0.078
	(0.257)
Mom Number of Kids	0.076**
	(0.035)
Married/Cohabiting	-0.175***
	(0.062)
Mom works	-0.032
	(0.119)
Mom received financial support pregnancy	0.002
	(0.097)
Mom Medicaid	0.123
	(0.084)
Mom government housing	0.105
	(0.086)
Mom good health	-0.181
	(0.165)

Continued on next page

Table 2.4: ***continued***

Covariate	
Mom smoke pregnancy	0.058
	(0.122)
Mom drank alcohol pregnancy	-0.160
	(0.138)
Mom used drugs pregnancy	0.115
	(0.177)
Mom – drinking/drugs interfered with daily life	-0.154
	(0.267)
Mom was treated drug/alcohol problems	0.630***
	(0.224)
Length of time mom knew partner	0.026**
	(0.012)
Partner supported mom pregnancy	0.192*
	(0.110)
Partner works	-0.204
	(0.124)
Partner-other activities to generate income	0.136
	(0.124)
Partner-physical/mental condition limits work	-0.198
	(0.155)
Partner-drinking/drugs interfered with daily life	0.328*
	(0.180)

Notes: Standard errors are clustered by city of residence and are included in parentheses. Regression includes city of residence dummy variables.
*** p<0.01, ** p<0.05, *p<0.1

Table 2.5: Test of Balancing Property between the Treatment and Comparison Group
Treatment: Recently Incarcerated at Year 1 (excluding baseline incarceration)

	Difference	Paired t Statistics		Difference	Paired t Statistics
Partner Black	0.069	1.26	Mom financial support pregnancy	0.065	1.13
Partner Hispanic	-0.054	-1.09	Mom Medicaid	0.067	1.37
Partner Other	0.003	0.11	Mom government housing	0.085	1.62
Partner & Mom diff. Race	-0.017	-0.44	Mom good health	-0.035	-0.94
Mom Age	-0.884	-1.47	Mom smoke pregnancy	0.061	1.18
Partner Age	-0.608	-0.75	Mom alcohol pregnancy	0.008	0.25
Mom Foreign born	-0.043	-1.41	Mom used drugs pregnancy	0.031	0.95
Partner Foreign born	-0.041	-1.67	Mom-drinking/drugs interfered with daily life	0.019	0.78
Mom < HS Education	0.090	1.56	Mom was treated drug/alcohol problems	0.040	1.33
Partner < HS Education	0.077	1.35	Length of time mom knew dad	0.062	0.11
Married/Cohabiting	-0.089	-1.54	Partner supported mom pregnancy	0.030	0.66
Mom No of Kids	0.111	0.68	Partner works	-0.098	-1.78
Mom lived with both parents at age 15	-0.052	-0.96	Partner other activities to generate income	0.022	0.52
Mom access to family support	-0.010	-0.46	Partner physical/mental condition limits work	0.005	0.17
Mom works	-0.063	-1.12	Partner-drinking/drugs interfered with daily life	0.041	1.22

Notes: The t-tests are based on Epanechnikov matching with a bandwidth of 0.15. The differences in the variable means are taken between the treated group and the matched comparison group.

Table 2.6: OLS and Matching Results of the Effect of Partner Incarceration on the Public Assistance Participation of Mothers for Year 1 Sample
Treatment: Recently Incarcerated at Year 1 (excluding baseline incarceration)

	Full Sample			Matched Sample				
	Mean Outcome	OLS Unadjusted	OLS Adjusted	Mean Outcome	OLS Unadjusted	OLS Adjusted	Matching Results Epanechnikov	Tricube
	1	2	3	4	5	6	7	8
Dependent Variable:								
Welfare Participation	0.228	0.274***	0.160***	0.278	0.214***	0.151***	0.168***	0.156***
		(0.029)	(0.030)		(0.027)	(0.030)	(0.028)	(0.028)
Food Stamps Participation	0.358	0.291***	0.150***	0.433	0.210***	0.145***	0.163***	0.151***
		(0.032)	(0.037)		(0.037)	(0.040)	(0.043)	(0.042)
No. of Observations		3744	3744		2790	2790	2790	2790

Notes: Treatment is defined as partner recently incarcerated at year 1, which excludes partners incarcerated at baseline. All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. Mean outcome refers to the mean public assistance participation rate for the corresponding sample. OLS unadjusted is the unadjusted mean difference in public assistance participation between the treated and control groups of the corresponding sample. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). OLS and matching estimates can be interpreted as percentage point increases relative to the baseline means as reported in the mean outcome column. Propensity score matching estimates are reported using a bandwidth of 0.15. Standard errors clustered by city of residence (OLS) and bootstrapped standard errors drawn by city of residence with 200 replications (Matching) are reported in parentheses . *** p<0.01, ** p<0.05, * p<0.1.

Table 2.7: Sensitivity of Matching Results to choice of the bandwidth

	Bandwidth=0.10		**Bandwidth=0.15**		**Bandwidth=0.20**	
Kernel Function:	Epanechnikov	Tricube	Epanechnikov	Tricube	Epanechnikov	Tricube
	1	2	3	4	5	6
Dependent Variable:	0.139***	0.128***	0.168***	0.156***	0.188***	0.177***
Welfare Participation	(0.029)	(0.027)	(0.028)	(0.028)	(0.027)	(0.023)
	0.134***	0.123***	0.163***	0.151***	0.182***	0.171***
Food Stamps Participation	(0.044)	(0.042)	(0.043)	(0.042)	(0.040)	(0.039)
No. of Observations	2790	2790	2790	2790	2790	2790

Notes: Matching results in Table 2.6 are reported with a bandwidth of 0.15, which is the baseline point for bandwidth robustness analysis. Bootstrapped standard errors drawn by city of residence with 200 replications are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.8: OLS and Matching Results of the Effect of Partner Incarceration on the Public Assistance Participation of Mothers for Year 1 Sample
Treatment: Incarcerated at Year 1 (including baseline incarceration)

	Full Sample			Matched Sample				
	Mean Outcome	OLS Unadjusted	OLS Adjusted	Mean Outcome	OLS Unadjusted	OLS Adjusted	Matching Results Epanechnikov	Tricube
	1	2	3	4	5	6	7	8
Dependent Variable:								
Welfare Participation	0.240	0.321***	0.208***	0.275	0.288***	0.202***	0.237***	0.226***
		(0.024)	(0.026)		(0.023)	(0.026)	(0.024)	(0.023)
Food Stamps Participation	0.369	0.314***	0.173***	0.418	0.265***	0.170***	0.210***	0.199***
		(0.032)	(0.030)		(0.034)	(0.032)	(0.034)	(0.032)
No. of Observations		3879	3879		3263	3263	3263	3263

Notes: Treatment is defined as partner incarcerated at year 1, which may include partners also incarcerated at baseline. All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. Mean outcome refers to the mean public assistance participation rate for the corresponding sample. OLS and matching estimates can be interpreted as percentage point increases relative to the baseline means as reported in the mean outcome column. Propensity score matching estimates are reported using a bandwidth of 0.15. Standard errors clustered by city of residence (OLS) and bootstrapped standard errors drawn by city of residence with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.9: OLS and Matching Results of the Effect of Partner Incarceration on the Public Assistance Participation of Mothers for Year 3 Sample
Treatment: Recently Incarcerated at Year 3 (excluding baseline and year 1 incarceration)

	Matched Sample: Covariates measured at Baseline					Matched Sample: Covariates measured at Baseline and Year 1				
	Mean Outcome	OLS Unadjusted	OLS Adjusted	Matching Results Epanechnikov	Matching Results Tricube	Mean Outcome	OLS Unadjusted	OLS Adjusted	Matching Results Epanechnikov	Matching Results Tricube
	1	2	3	4	5	6	7	8	9	10
Dependent Variable:										
Welfare Participation	0.224	0.216***	0.151***	0.169***	0.160***	0.243	0.197***	0.143***	0.146***	0.142***
		(0.041)	(0.041)	(0.040)	(0.044)		(0.046)	(0.046)	(0.047)	(0.048)
Food Stamps Participation	0.429	0.243***	0.156***	0.166***	0.152***	0.456	0.210***	0.141**	0.138***	0.131***
		(0.052)	(0.048)	(0.048)	(0.043)		(0.053)	(0.050)	(0.043)	(0.044)
No. of Observations		2272	2272	2272	2272		2038	2038	2038	2038

Notes: Treatment is defined as partner recently incarcerated at year 3, which excludes partners incarcerated at baseline and year 1. All models include city of residence dummy variables. The matched samples are restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group for the specified model. The propensity model for the sample in the first panel includes covariates measured in the baseline period only. The propensity model of the second panel includes the variables measured at baseline as in panel 1, along with additional variables measured in year 1. Mean outcome refers to the mean public assistance participation rate for the corresponding sample. OLS and matching estimates can be interpreted as percentage point increases relative to the baseline means as reported in the mean outcome column. Propensity score matching estimates are reported using a bandwidth of 0.15. Standard errors clustered by city of residence (OLS) and bootstrapped standard errors drawn by city of residence with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2.10: OLS and Matching Results of the Effect of Partner Incarceration on the Public Assistance Participation of Mothers for Year 5 Sample
Treatment: Recently Incarcerated at Year 5 (excluding baseline, year 1 incarceration, and year 3 incarceration)

	Matched Sample: Covariates measured at Baseline					Matched Sample: Covariates measured at Baseline and Year 1				
	Mean	OLS	OLS	Matching Results		Mean	OLS	OLS	Matching Results	
	Outcome	Unadjusted	Adjusted	Epanechnikov	Tricube	Outcome	Unadjusted	Adjusted	Epanechnikov	Tricube
	1	2	3	4	5	6	7	8	9	10
Dependent Variable:										
Welfare Participation	0.166	0.261***	0.214***	0.212***	0.201***	0.183	0.245***	0.210***	0.201***	0.194***
		(0.044)	(0.050)	(0.045)	(0.045)		(0.044)	(0.051)	(0.046)	(0.051)
Food Stamps Participation	0.423	0.403***	0.326***	0.341***	0.330***	0.457	0.370***	0.314***	0.317***	0.308***
		(0.048)	(0.056)	(0.048)	(0.051)		(0.050)	(0.056)	(0.049)	(0.050)
No. of Observations	2132	2132	2132	2132	2132	1829	1829	1829	1829	1829

Notes: Treatment is defined as partner recently incarcerated at year 5, which excludes partners incarcerated at baseline, year 1, and year 3. All models include city of residence dummy variables. The matched samples are restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group for the specified model. The propensity model for the sample in the first panel includes covariates measured in the baseline period only. The propensity model of the second panel includes the variables measured at baseline as in panel 1, along with additional variables measured in year 1 and year 3. Mean outcome refers to the mean public assistance participation rate for the corresponding sample. OLS and matching estimates can be interpreted as percentage point increases relative to the baseline means as reported in the mean outcome column. Propensity score matching estimates are reported using a bandwidth of 0.15. Standard errors clustered by city of residence (OLS) and bootstrapped standard errors drawn by city of residence with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 2.1: Test of Balancing Property between the Treatment and Comparison Group Treatment: Recently Incarcerated at Year 1 (including baseline incarceration)

	Difference	Paired t Statistics
Partner Black	0.090	1.99
Partner Hispanic	-0.041	-1.00
Partner Other	-0.006	-0.34
Partner & Mom diff. Race	-0.023	-0.73
Mom Age	-0.929	-1.90
Partner Age	-0.854	-1.33
Mom Foreign	-0.041	-1.76
Partner Foreign	-0.037	-1.79
Mom < HS	0.092	1.94
Partner < HS	0.101	1.99
Mom both Parents	-0.045	-1.01
Mom access to family support	-0.006	-0.33

Appendix Table 2.2: Test of Balancing Property between the Treatment and Comparison Group
Treatment: Recently Incarcerated at Year 3 (excluding baseline incarceration and year 1 incarceration), covariates measured at baseline

	Difference	Paired t Statistics		Difference	Paired t Statistics
Partner Black	0.067	1.18	Mom financial support pregnancy	0.099	1.67
Partner Hispanic	-0.050	-1.01	Mom Medicaid	0.060	1.12
Partner Other	0.005	0.23	Mom government housing	0.077	1.36
Partner & Mom diff. Race	0.010	0.20	Mom good health	0.012	0.40
Mom Age	-0.852	-1.43	Mom smoke pregnancy	0.051	0.88
Partner Age	-1.266	-1.65	Mom alcohol pregnancy	0.004	0.11
Mom Foreign	-0.046	-1.53	Mom used drugs pregnancy	0.014	0.44
Partner Foreign	-0.037	-1.26	Mom-drinking/drugs interfered	0.012	0.47
Mom < HS	0.035	0.56	Mom treated drug/alcohol problems	0.006	0.20
Partner < HS	0.080	1.28	Length of time mom knew dad	-0.234	-0.44
Married/Cohabiting	-0.103	-1.65	Partner supported mom pregnancy	0.054	1.23
Mom No of Kids	0.101	0.59	Partner works	-0.073	-1.25
Mom both Parents	-0.010	-0.17	Partner other activities to generate income	0.021	0.45
Mom access to family support	0.007	0.29	Partner physical/mental condition limits work	0.001	0.03
Mom works	-0.015	-0.25	Partner-drinking/drugs interfered	0.034	1.02

Appendix Table 2.3: Test of Balancing Property between the Treatment and Comparison Group
Treatment: Recently Incarcerated at Year 3 (excluding baseline incarceration and year 1 incarceration), covariates measured at baseline and year 1

	Difference	Paired t Statistics		Difference	Paired t Statistics
Partner Black	0.049	0.86	Mom alcohol pregnancy	0.004	0.10
Partner Hispanic	-0.041	-0.82	Mom used drugs pregnancy	0.015	0.49
Partner Other	0.004	0.18	Mom-drinking/drugs interfered	0.009	0.36
Partner & Mom diff. Race	0.014	0.3	Mom treated drug/alcohol problems	0.004	0.15
Mom Age	-0.701	-1.2	Length of time mom knew dad	-0.160	-0.30
Partner Age	-1.073	-1.43	Partner supported mom pregnancy	0.034	0.77
Mom Foreign	-0.038	-1.27	Partner works	-0.073	-1.22
Partner Foreign	-0.027	-0.95	Partner other activities to generate income	0.017	0.35
Mom < HS	0.045	0.71	Partner physical/mental condition limits work	0.008	0.24
Partner < HS	0.072	1.13	Partner-drinking/drugs interfered	0.037	1.11
Married/Cohabiting	-0.084	-1.33	Mom Anxious	-0.008	-0.38
Mom No of Kids	0.108	0.62	Mom Depressed	-0.010	-0.20
Mom both Parents	-0.006	-0.11	Mom Age 1st birth	-0.528	-1.28
Mom access to family support	0.004	0.17	Breastfed	-0.067	-1.08
Mom works	-0.021	-0.35	Mom cosigner avail	-0.030	-0.47
Mom financial support pregnancy	0.081	1.36	Mom access $200 loan	-0.003	-0.07
Mom Medicaid	0.056	1.06	Mom access $1000 loan	-0.050	-0.83
Mom government housing	0.060	1.04	Mom work since birth	0.004	0.07
Mom good health	0.013	0.42	Mom bank account	-0.046	-0.77
Mom smoke pregnancy	0.050	0.87	Mom credit card	-0.059	-1.15

Chapter 3

The Impact of the Incarceration of Fathers on the Health of Mothers and Development of Children

3.1 Introduction

This chapter examines the causal relationship between paternal incarceration and the health of mothers and the development of young children. Using data from the Fragile Families and Child Wellbeing Study, I examine the effect of a father's incarceration on the cognitive development and social behavior of young children. I also examine the effect of a partner's incarceration on the physical and mental health of mothers. I employ propensity score matching techniques to address the non-random selection of families with incarcerated fathers. I find that, among children with incarcerated fathers, paternal incarceration adversely affect cognitive development and increases aggressive behavior in children at age five, but I find no evidence of an incarceration effect on children at age 3. I also find that, among women with incarcerated partners, a partner's incarceration increases the probability that mothers experience depression, and increases the probability that mothers report being in good physical health. However, I find no evidence that incarceration adversely affects mother's level of anxiety.

3.2 Background

The direction of the effect of paternal incarceration on the outcomes of children and mothers is theoretically ambiguous. One mechanism through which paternal incarceration may impact young children is through the involuntary separation of the father from the household. Previous research has shown that paternal absence adversely affects child outcomes (McLanahan and Sanderfur, 1994, Antecol and Bedard 2007, Lang and Zagorsky, 2001, Painter and Levine, 2000). Incarceration greatly limits fathers' ability to frequently interact with his children. When not incarcerated, many unwed fathers interact with their children on a regular basis (Edin and Lein 1997, McLanahan et al. 1998). Although many incarcerated fathers maintain at least monthly contact with their children,[36] this contact is often limited to occasional weekend visits, telephone calls, and letters (Mumbola 2000). This disruption in attachment development due to the involuntary separation of the father from his children, particularly at an early age, may adversely affect a child's development and wellbeing.

Incarceration may impact mothers and children through its effect on household economic conditions. After a father is imprisoned, he is unable to contribute financial to his family's household, which may often lead to a decrease in financial household resources for his family. This may result in financial strain for partners and children of incarcerated men (Hairston, 1998, Western and Wildeman 2009). Previous research has shown that families of incarcerated fathers are also at a higher risk for experiencing material hardship (Schwartz-Soicher, Geller, Garfinkel, 2010) and homelessness (Wildeman 2011). Incarceration of fathers has also been shown to adversely affect the

[36] 40 percent of fathers in state prison reported a minimum of weekly contact with their children and 62 percent reported a minimum of monthly contact (Mumola 2000).

economic wellbeing of mothers (Pruitt-Walker, 2011). Financial insecurity, material hardship, and housing instability may compromise both child wellbeing and mothers' health. Financial hardship is related to adverse behavior, academic, and health outcomes for children (Duncan and Brooks-Gunn, 1997) and mental health outcomes for women (Heflin and Iceland, 2009). Material hardship has been shown to increase the incidences of depression and anxiety among women (Heflin and Iceland, 2009, Whitaker, Phillips, and Orzo, 2006), as well as increase the probability that urban children display aggressive, anxious/depressed, and withdrawal behaviors (Gershoff, Aber, Raver and Lennon 2007, Zilanawala and Pilkauskas 2011). Children experiencing economic and material hardship have lower cognitive ability and academic achievement, as well as behavior problems and poor health conditions (Alaimo, Olson and Frognillo, 2001, Slack and Yoo, 2005, Gershoff, Raver, Aber and Lennon, 2007, Hauser, Brown, & Prosser 1997). Additionally, lack of stable housing has been associated with physical and mental health problems for adults and children, as well as academic difficulties for students (Haddad et al. 2005, Buckner 2008, Lee et al. 2010).

Through the mechanisms stated above, prior research suggests that incarceration is likely to have adverse effects on child development and mother's health. However, the effects of paternal incarceration may not be all negative. If the father was a negative influence on the family, his absence may enhance mother and child wellbeing and health. In cases where drug abuse or domestic violence was present, for instance, the father's absence may improve mother's health conditions and enhance child wellbeing. Previous research also suggests that high rates of male incarceration are associated with increases in employment and educational attainment, and lower non-marital fertility among women

(Charles and Luoh 2010, Kamdar 2007, Mechoulan 2010), which may enhance mothers health and child wellbeing.

The growing rate of incarcerated fathers entering the prison system[37] has motivated increasing interest among empirical researchers in estimating the effects of incarceration on families. Research in this developing line of research has mostly focused on outcomes for children or the offenders themselves, with very little research focusing on the mothers who share children with incarcerated men. This analysis is the first to my knowledge to examine empirically the effects of paternal incarceration on mothers' mental and physical health.

There are several empirical studies that use data from the Fragile Families Study to examine parental incarceration and child wellbeing for urban families. Geller et al. (2009) examine the effect of paternal incarceration history on several child developmental outcomes at age 3. They find that children of incarcerated fathers are marginally significantly more likely to display behavior problems in terms of aggression. However, the authors find no evidence that paternal incarceration is related to verbal ability or anxiety/depressive behavior. Although controlling for a large range of observable characteristics, as stated in the analysis, the authors did not seek to establish a causal relationship between paternal incarceration and child wellbeing. Using fixed effects and propensity score matching model models, Wildeman (2010) finds a positive relationship between paternal incarceration and physical aggressive behavior for boys at age 5. This result holds for paternal incarceration as measured by both past incarceration history at age 5, as well as recent paternal incarceration between years 3 and 5. Using

[37] In 1991 there were 423,000 incarcerated men in state or federal prison. This number has increased to 744,200 in 2007, which is a 76 percent increase from 1991.

fixed effects models, Geller, Cooper, and Western (2010) also find that past and recent paternal incarceration is associated with significant increases in children's aggressive behavior at age 5. However, paternal incarceration does not significantly affect internalizing behavior or verbal ability. Craigie (2008) finds that paternal incarceration history exacerbates aggressive and ODD symptoms in young children, but lowers their cognitive test scores. However, she also finds that the effect of paternal incarceration on child's development is not statistically different from the effect of his absence.

3.3 Data and Measures

The data for this analysis is drawn from the Fragile Families and Child Wellbeing Study. This study follows a cohort of approximately 4,700 new parents and their children residing in twenty large US cities in fifteen states. Beginning in 1998-2000, both parents were initially interviewed in the hospital shortly after the birth of their children, hereafter referred to as the baseline interview period. Follow-up interviews were conducted 1, 3, and 5 years afterwards. These interviews are referred to as the core study. At the three-year and five-year follow up periods, data was collected from a subsample of core respondents on various domains of the child's home environment and development. This component of the FFCWS is referred to as the 'In Home Longitudinal Study of Pre-school Aged Children' and will be used for the analysis of child outcomes.

Incarceration Measures

Father's current incarceration status is measured at three points in time in this analysis: at the one year, three year, and five year core survey periods. The incarceration status of the father is derived from a combination of the mother's report of the father's

incarceration status and father's report of his own status. If either the father or mother report that the father is incarcerated at the time of interview, either directly or indirectly, he is considered as currently incarcerated.

Mother Outcome Measures

Mothers' health measures are drawn from the mother's core interviews for the three follow-up periods. Physical health is measured by mothers' self-reported health status. Mothers were asked to classify their health as excellent, very good, good, fair, or poor. I convert this to a dichotomous outcome variable where I classify women as being in good health if they responded with excellent, very good, or good health; responses of fair or poor health are classified as being in bad health.

I examine two components of maternal mental health: depression and anxiety. Depression is a common but serious illness in which a person feels discouraged, sad, hopeless, unmotivated, or uninterested in life in general. Generalized Anxiety Disorder (GAD) is an anxiety disorder characterized by chronic anxiety, exaggerated worry and tension[38]. Women are more likely than men to be diagnosed with depression and anxiety (Kessler et al., 2003). According to the Center for Disease Control, depression and anxiety are two major causes of illness and death in the United States and are associated with reduced quality of life, social functioning, and excess disability. Psychiatric conditions such as depression can contribute to or worsen chronic diseases[39]. The mental health of mothers has important implications for child wellbeing. Maternal depression has been linked to behavior problems in children as well as unfavorable health outcomes,

[38] Source: National Institute of Mental Health, http://www.nimh.nih.gov/health/publications/generalized-anxiety-disorder-gad/generalized-anxiety-disorder-gad-when-worry-gets-out-of-control.shtml. Accessed May 2011

[39] Source: http://www.cdc.gov/Features/dsBRFSSDepressionAnxiety. Accessed May 2011

which may have long term implications into adulthood (Turney, 2001, Turney, Forthcoming).

Symptoms of major depression (MD) and generalized anxiety disorder (GAD) are measured using the Composite International Diagnostic Interview-Short Form (CIDI-SF)[40], Section A (Kessler et al. 1998). The CIDI is a standardized instrument for assessment of mental disorders and is consistent with the *Diagnostic and Statistical Manual of Mental Health Disorders – Fourth Edition* (American Psychiatric Association, 1994). The short form of the CIDI interview takes a portion of the full set of CIDI questions and generates the probability that the respondent would be a case, or positively diagnosed, if given a full CIDI interview.

Measures of depression are coded in years 1, 3, and 5 of the core interviews. Mothers are asked whether they have had feelings of dysphoria (depression) or anhedonia (inability to enjoy what is usually pleasurable) in the past year that lasted for two weeks or more, and if so, whether the symptoms lasted most of the day and occurred every day of the two week period. If so, they were asked more specific questions about depressive symptoms, including: 1) losing interest, 2) feeling tired, 3) change in weight, 4) trouble sleeping, 5) trouble concentrating, 6) feeling worthless, and 7) thinking about death. Following previous research, I construct a binary variable for maternal depression, where mothers who reported 3 or more symptoms are coded to be depressed[41] (Turnery and Carlson, 2011, Reese and Sabia, 2007). A score of 3 or higher on the CIDI-SF has been

[40] The short form of the CIDI interview asks a portion of questions from the full CIDI and generates from the responses the probability that the respondent would be a "case," or positively diagnosed respondent if given a full CIDI interview.

[41] Participants who report that they are currently taking medication for depression are not asked questions about symptoms and are also considered to be depressed.

shown to be associated with having a greater than 0.5 probability of meeting the full diagnosis criteria for major depression (Walters et al. 2002).

Measures of anxiety are coded in years 1 and 3 of the core interviews[42]. Anxiety is indicated by a period of six months or more when an individual feels excessively worried or anxious about more than one thing, more days than not, and has difficulty controlling their worries. Other symptoms include: 1) being keyed up or on edge, 2) irritability, 3) restlessness, 4) having trouble falling asleep, 5) tiring easily, 6) difficulty concentrating, and 7) tense or aching muscles. Similar to the depression measure, I construct a binary variable for maternal anxiety, and mothers who report 3 or more symptoms are coded as experiencing anxiety.

Child Outcome Measures

I focus on two components of child wellbeing: child cognitive development and social behavior. Child outcomes measures are drawn from maternal reports given in the 3 and 5 year In Home surveys. Child behavior outcomes are measured using the Child Behavior Checklist (CBCL), which is a widely used scale for assessing problematic behavior for young children (Achenbach, 1991). The CBCL includes subscales for identifying externalizing and internalizing behaviors. Externalizing behaviors include outward displays of aggressions, while internalizing behaviors include anxiety and depression. Appendix Table 3.1 presents the list of items used to construct the behavioral scales for aggressive and anxiety/depressed behavior. The items relating to each type of behavior differ for age 3 and age 5 to account for age appropriateness. Mothers were asked to rate each assessment item with 0 (not true), 1 (sometimes or somewhat true), or

[42] Questions regarding mother's anxiety are not asked in the 5 year interview period.

2 (very true or often true). I create aggressive and anxiety/depressive behavior indices for children at ages 3 and 5 by averaging the behavior items, yielding an index ranging from 0 to 2, with a higher index indicating a higher level of aggressive behavior.

Cognitive ability is measured by the Peabody Picture Vocabulary Test (PPVT), which is a widely used indicator of verbal ability. Scores were standardized in order to adjust for comparison to peers of the same age. The PPVT has shown to be an indicator of scholastic aptitude and intellectual ability (Dunn and Dunn, 1997).

Summary Statistics

Data is drawn from mothers' reports and the analysis restricted to parents age 18 and older. Table 3.1 presents mean characteristics of the baseline sample. Approximately 46 percent of couples are Black, and 27 percent are Hispanic. Mothers are slightly younger than fathers, with an average age of 25 for mothers and 28 for fathers. Over 30 percent of parents have less than a high school education and only 25 percent are married. Thirty five percent of mothers receive public assistance and 16 percent reside in government assisted housing. Average household income is $32,000 and 35 percent are living below the poverty level. With high incidences of single parenthood, low education and high rates of poverty, the children in the Fragile Families Study appear to be at a greater disadvantage.

As discussed above, data for the analysis of child outcomes is drawn from the In Home Survey, which is a subsample of the core survey. Table 3.2 presents a comparison of mean characteristics for mothers who participated in the In Home Survey and mothers who participated in the core survey but not the In Home Survey. Means are compared for both the year 3 and year 5 studies, and paired t-statistics are presented in order to assess if

there are significant differences between mothers who opted not to participate in the in-home assessments. Of the 4,190 mothers in the year 3 core interview, 3,252 mothers also participated in the 3 year in home study, representing 78% of the core sample of mothers. Meanwhile, 2,959 of the 4,099 mothers in the core 5 year interview participated in the 5 year in home interview, which is 72% of the 5 year core sample of mothers. There are small differences between participants and non-participants in the In-Home Survey. Hispanic mothers and mothers of Other race and married mothers are less likely and Black mothers are more likely to be in the 5 year In-Home Survey. Foreign-born mothers are less likely to participate in both In Home surveys.

3.4 Results

Table 3.3 presents comparisons of means by father's incarceration status for the mother and child outcome variables. The table reports mother's outcomes in year 1 and child outcomes in year 3. The sample size for child outcomes is smaller due to missing observations and only a subsample of mothers in the core sample participated in the in-home survey. Overall, 93 percent of women in the ample report being in good physical health, 12 percent meet the depression criteria, and a relatively small percent of the sample, 2.4 percent, experience anxiety. Among mothers with incarnated partners, 87 percent report good health, while 93 percent of mothers whose partners are not incarcerated report good health. Nearly 15 percent and 3 percent of mothers with incarcerated partners are depressed and anxious, respectively, compared to 11.8 percent and 2.4 percent of their counterparts who experience these symptoms. Overall,

unadjusted for any observable characteristics, mothers with incarcerated partners appear to have poorer physical and mental health outcomes than other mothers in the sample.

Children's PPVT score is a continuous variable ranging from 40 to 137 and has a mean value of 86 points. The minimum value of both child behavior indices is 0 and has maximum values of 1.94 for aggression and 1.63 for anxiety/depression. The average index score is 0.58 for aggression and 0.41 for anxiety/depression. On average, children with incarcerated fathers score about 5 points lower on the PPVT exam, with a mean score of 82, compared to a mean score of 87 for their peers. Children with incarcerated fathers exhibit more behavior problems than children whose fathers are not incarcerated. These children have an average score on the aggression and anxiety/depression index of 0.68 and 0.48, respectively, compared to aggression and anxiety/depression scores of 0.58 and 0.41 for children whose fathers are not incarcerated. These mean differences suggest that children with incarcerated fathers have poorer development and behavior outcomes than their counterparts.

While there appears to be clear mean differences in outcomes between mothers and children with and without incarcerated fathers, these patterns may be correlated with other unobservable characteristics of the mother or child. The families of incarcerated fathers differ along several dimensions that are likely to influence paternal incarceration, child development, and maternal health. As Table 3.1 reports, several individual and household characteristics vary by father's incarceration status. In terms of basic demographic characteristics, mothers with incarcerated partners differ in terms of race, age, and educational attainment. Mothers with incarcerated partners are less likely to have a high school education and more likely to have partners that are Black or Hispanic

and without a high school education. The next step in the analysis is therefore to control for these demographic characteristics using an OLS model.

3.4.1 OLS Results

Comparison of means suggest that, unconditionally, paternal incarceration is associated with adverse outcomes for mothers and children. I will now explore how these relationships change once demographic characteristics are added to the model. I estimate a regression equation of the effects of paternal incarceration on various outcome measures of mothers in year 1 and children in year 3 of the following form[43]:

$$Y_{it} = \alpha + \beta I_{it} + \gamma X_i + \varepsilon_{it} \quad (1)$$

Y_{it} represents child and mother outcomes; X_i is a vector of basic demographic characteristics measured at the baseline period, including parent's race, age, education, and city of residence; and I_{it} is a binary variable equal to 1 if the father is recently incarcerated at the year 1 follow-up period (excluding partners incarcerated at baseline) for mother's outcomes and recently incarceration in year 3 for child outcomes. Finally, unobservables affecting Y_{it} are captured in ε_{it}, If X_i and I_{it} are uncorrelated with ε_{it} the estimate of β will estimate the causal effect of interest.

Table 3.4 reports the OLS estimates of the effects of paternal incarceration on various outcomes of mothers in year 1 and children in year 3. The odd number columns show the unadjusted mean difference in the outcome variables for children and mothers by father's incarceration status, which is the OLS regression without any controls. The

[43] I begin by analyzing results for the year 1 sample for mothers and year 3 sample for children

even number columns report the mean outcome differences after adjusting for basic demographic characteristics.

The results for child outcomes are presented in Table 3.4.1. Unadjusted for any covariates, children with incarcerated fathers score 5 points lower on the PPVT and this difference is significant at the 5 percent level. The standard deviation of the test score is 16.83. The 5 point difference represents about 30 percent of the standard deviation, which is a moderate effect size. Paternal incarceration also significantly increases anxiety/depression behavior by 0.064. This represents an increase of 21 percent of the standard deviation, which is a small-moderate effect. Paternal incarceration also increases the aggression index by 0.076 (23 percent of the standard deviation), although this result is not statistically significant.

After controlling for basic demographic characteristics as reported in the adjusted OLS columns, the direction of the effects remain the same across all child outcomes, but the magnitude of the coefficients are reduced and none of the estimates are statistically significant. Having an incarcerated father lowers test scores by 3 points, which is 12 percent of the standard deviation. In terms of behavior outcomes, paternal incarceration increases the aggression index by 0,035 (10 percent of standard deviation) and increases anxiety/depression by 0.018 (6 percent of the standard deviation. Once adjusting for demographic characteristics, the coefficients for all three outcomes are reduced by over half and the differences in outcomes are not statistically different from zero.

Covariates that have the largest influence on child outcomes are father's race and parent's educational attainment. Having a Black father significantly reduces child's average PPVT score by 10 points and increases the aggression and anxiety/depression

indices by 0.045 and 0.119, respectively. Having a Hispanic father significantly reduces average test scores by 9 points and increases anxiety/depression by 0.12, but does not significantly affect the aggression index. Children with older mothers have higher test scores, while a having a foreign-born mother negatively affects test scores and increases anxiety/depression. Having a father with low education significantly reduces test scores, and having a mother or father without a high school education significantly increases aggression and anxiety/depression.

Table 3.4.2 presents OLS results for mother outcomes. Unadjusted mean differences report that mothers with incarcerated partners are 3.5 percentage points more likely to be depressed, which is about a 30 percent increase from the mean. This difference is significant at the 10 percent level. Having an incarcerated partner decreases the likelihood that a mother report good health by 6.4 percentage points (7 percent increase from the mean) and increases the likelihood of anxiety by 0.08 percentage points (33 percent increase from the mean), but these results are not statistically significant.

Once control variables are added to the model, the magnitudes of the coefficients are reduced. Mothers with incarcerated partners are 5.1 percentage more likely to be in good health (5.5 percent increase from the mean), and a partner's incarceration increases the likelihood of depression and anxiety by 2.7 percentage points (23 percent increase from the mean) and 0.06 percentage points (25 percent increase from the mean), respectively. However, after adjusting for demographic characteristics, none of these estimates are statistically different from zero. Covariates that significantly adversely affects mother's health are being minority, and if she or her partner has less than a high

school education. Meanwhile, mothers with low education are significantly more likely to experience depression and anxiety.

The OLS results imply that several demographic factors influence both paternal incarceration and child and mother outcomes in the same direction, suggesting that upward selection bias may be an issue. In addition to the unadjusted mean differences in demographic characteristics, Table 3.1 shows that mothers and children with incarcerated fathers are at a disadvantage in terms of socioeconomic and familial circumstances. Paternal incarceration is associated with higher rates of poverty, lower household income and educational attainment, and higher occurrences of drug use. It is therefore unclear if the differences in the outcomes of interest are a direct result of paternal incarceration or these confounding factors. Propensity score matching methods are exploited to assess the casual relationship between paternal incarceration and child and mother outcomes. Employing this method allows for the inclusion of many more covariates that are likely to influences both paternal incarceration and family outcomes that are not typically included in an OLS framework.

3.4.2 Estimation of the Propensity Score

Let treatment be defined as a mother having a newly incarcerated partner or a child with a newly incarcerated father. The ideal approach to establish causality between paternal incarceration and the outcomes of interest is to identify the potential outcomes of mothers and children if the fathers had never become incarcerated. Since this counterfactual outcome cannot be directly observed, I must rely on observed information of the control group in order to estimate the counterfactual. With the standard OLS

model, average outcomes of all control observations in the sample are used in the counterfactual. However, this could be problematic if the average outcome is taken over observations with very different characteristics than those of the treatment group. For example, outcomes of mothers and children who experience paternal incarceration are potentially compared to mothers and children who have different characteristics and conditions, in addition to differences in their treatment status. Due to the potential for these confounding factors, it is therefore difficult to conclude that the relationship is casual by simply using OLS estimation. Propensity score matching overcomes this problem by matching each treated observation only with control observations who share similar observable characteristics. I estimate the average treatment effect on the treatment, which is the effect of paternal incarceration on mothers and children whose fathers are incarcerated. The differences in outcomes can be attributed to treatment, implying a causal relationship.

The propensity score is estimated using a probit, yet other probability models yield similar results. The covariates used in the probit model are observed characteristics that affect both the propensity for incarceration and mother/child outcomes. Covariates should also be measured prior to treatment or fixed over time, so as to be independent of assignment into treatment. I will present two different propensity score models for mother and child outcomes. The model for mother outcomes defines treatment as recently incarcerated in year 1, excluding partners incarcerated at baseline. Covariates in this model are measured at the baseline interview period. The model for child outcomes defines treatment as recently incarcerated in year 3, excluding fathers incarcerated at the baseline and year 1 interview periods. Covariates are measured at baseline and year 1.

The propensity for father incarceration is defined as a function of parent's demographic and socioeconomic characteristics, health and capabilities, substance abuse, and controls for city of residence.

The matched sample for mother outcomes include 2,960 observations with propensity scores falling within the region of common support [0.00284, 0.47861]. The region of common support excludes 805 non-treated units from the matching analysis with propensity scores lower than 0.00284, which is the minimum propensity score of the non-treated group. Mothers with propensity scores in this low range have observable characteristics that are substantially different from mothers in the treated group. The matched sample for child outcomes includes 1,019 observations with propensity scores falling within the region of common support [0.010748, 1]. Similar to the mother's sample, 837 non-treated observations with propensity scores lower than 0.01078 are excluded from the matching analysis.

Table 3.5.1 presents the probit estimates of the propensity score for the mother and child samples. Mothers with incarcerated partners are significantly more likely to be younger, have more children, and to have partners that are Black and have less than a high school education. They are less likely to have partners that are foreign born, more likely to have received treatment for drugs or alcohol use, and have known their partners for a longer period of time. Their partners are also less likely to be employed and more likely to use drugs and alcohol. As reported in Table 3.5.1, children with incarcerated fathers are significantly more likely to have fathers that are Black and have less than a high school education, mothers who use drugs, and are more likely to experience material hardship.

The estimated propensity score model should have a balanced set of covariates between the treated and comparison units. This implies that the means for each characteristic are statistically equal across both groups. Tables 3.6.1 and 3.6.2 present results of the balancing test between treatment and comparison groups for mother and child groups. Paired t-statistics for each covariate in the propensity model are reported to determine if covariate means between the treated and comparison units are statistically equal to zero. The tables show that the balancing condition is satisfied.

3.4.3 Propensity Score Matching Results

Matching Results for Child Outcomes

Table 3.7.1 presents the matching results of paternal incarceration on child developmental outcomes measured at ages 3 and 5. Column 1 reports the mean and standard deviation of each outcome variable. The adjusted OLS results for the reduced matched sample are reported in column 2; this model controls only for basic demographic characteristics such as age, race, and education. Propensity score matching estimates based on the Epanechinikov and Tricube kernel functions are presented in columns 3-6. These results represent the causal effect of paternal incarceration. I report results using two different bandwidths in order to assess the sensitivity of the matching estimates to the choice of bandwidth.

Results for child outcomes at age 3 are presented in the top panel of Table 3.7.1. Results suggest that having an incarcerated father reduces a child's PPVT score by about 1 point, which is only about 6.4 percent of the standard deviation. Partner incarceration increases the aggression index by 0.30 (8.37 percent of the standard deviation) and

increases the anxiety/depression index by 0.31 (10 percent of the standard deviation). The matching estimates are slightly higher than the OLS estimates for test scores, and slightly higher than the OLS estimates for the behavior indices. However, none of the estimates are statistically different from zero.

I repeat the analysis for children at age 5 and present the results in the bottom panel of table 3.7.1. Treatment is now defined as father recently incarcerated in year 5, excluding fathers incarcerated at baseline, year 1 and year 3. Controlling for basic demographic characteristics in the OLS model suggest that having an incarcerated father significantly decreases test scores 3.75 points (24 percent of the standard deviation), significantly increases the aggression index by 0.14 (41.6 percent of the standard deviation), and significantly increases the anxiety/depression index by 0.04 (17 percent of the standard deviation). Columns 3-6 present the matching estimates. After controlling for a host of socioeconomic characteristics in the matching model, the coefficients on the anxiety/depression index is slightly lower than the OLS estimates, but is no longer statistically significant. Paternal incarceration significantly increases test scores at age 5 by 4 percentage points, and this represents a moderate 26 percent of the standard deviation. Paternal incarceration also increases the aggression index by 0.143-0.152, which is about a moderate-large 45 percent of the standard deviation. The coefficients for PPVT and aggression index are slightly larger than the OLS results, but are qualitatively similar suggesting that selection on basic demographic characteristics largely explain the differences in child outcomes.

The results show that paternal incarceration adversely affects test scores and exacerbates aggressive behavior at age 5, but has no statistically significant effect at age

3. There are reasons to believe ex-ante that the results may be different for children at age 3 and age 5. The samples for each year represent a different treatment group of children at different ages and stages of development, which may yield different treatment effects. It should also be noted that the set of behavior questions differ for children at age 3 and age 5 (see Appendix Table 3.1). Although the two checklists contain age appropriate questions to detect behavior problems, the measures are not directly comparable across years.

One reason why we may see significant results for aggression at age 5 and not age 3 is related to early child development. Aggressive behavior is defined as acts intended to hurt or destroy and object, animal, or person. Intentionality, an important component of aggression, is difficult to infer among infants and young toddlers (Shaw and Giovanelli, 2000). This can make proper diagnosis difficult. Additionally, many children at this age do not have the cognitive capacity to fully comprehend aggression until after age 3 (Shaw and Giovanelli, 2000). For these reasons, it is quite reasonable to see significant effects on development when children are slightly older.

Matching Results for Mother Outcomes

Table 3.7.2 presents OLS and matching estimates for mother outcomes in years 1, 3, and 5. For the year 3 sample, treatment is defined as partner recently incarcerated in year 3, excluding fathers incarcerated at baseline and year 1. For the year 5 sample, treatment is defined as partner recently incarcerated in year 3, excluding fathers incarcerated at baseline, year 1, and year 3.

The results for year 1 are presented in the top panel of Table 3.7.2. In the year 1 sample, the matching results indicate that having an incarcerated partner reduces the

likelihood of good health by 4.8 percentage points and increases anxiety by 0.06 percentage points for mothers, but these results are not statistically different from zero. The only outcome variable that is statistically significant in year 1 is depression. Having an incarcerated partner increases the probability of being depressed by 3.1 percentage points and is significant at the 10 percent level. This result holds over varying kernel functions and bandwidth. This represents a moderate 25 percent increase from the mean. In all cases, the matching results are very similar to the adjusted OLS results

The middle panel of Table 3.7.2 presents the results for year 3. The matching results show that having in incarcerated partner increases the probability that mothers have good health by 6 percentage points and this result is significant at the 1 percent level. This result is robust across kernel functions and bandwidths. The 6 percentage point increases represents a 7 percent increase from the mean. The matching results are slightly higher than but qualitatively similar to the OLS results. Depression and anxiety are also increased by having an incarcerated partner, but these effects are not statistically different from zero. In year 5, partner incarceration decreases the likelihood of good health and depression, but these results are not statistically significant. In most cases, the OLS and matching results are qualitatively similar, suggesting that selection bias may be limited to selection on basic demographic characteristics.

In terms of comparing treatment effects across the three time periods, it should be noted that the effects are estimated for a different treatment group of women with recently incarcerated partners at each period. Therefore, it is reasonable to believe ex-ante that the treatment effects may differ across time periods. The results suggest that partner incarceration significantly increases the probability that mothers experience

depression in year 1, but the effects of incarceration are not statistically different from zero in years 3 and 5 and the point estimates change signs across the years. As illustrated in Table 3.7.2, the standard errors for the coefficient on depression are smallest in the year 1 period. The standard errors in year 3 are about 1.5 times as large as in year 1, and the standard errors in year 5 are twice as large as in year 1. In a similar vein, partner incarceration has a positive and significant on mother's physical health in year 3, but the effects in years 1 and 5 are not statistically different from zero. In comparing the standard errors for the coefficients of physical health across years, we can see that the coefficients on health in year 3 have the smallest standard errors across all three time periods. The standard errors in year 1 are about 1.75 times as large as year 3, and the estimates in year 5 are twice as large as those in year 3. Therefore, one explanation as to why the estimates are significant for depression in year 1 and good health in year 3 only, is that the estimates are less precise in the others years, as illustrated by the larger standard errors in the periods where the estimates are not significant.

Another possible explanation as to why the estimates on depression are significant in year 1 but not in the other years is related to postpartum depression. Recall that the year 1 follow up interview was conducted when children were approximately 1 year old. According to the National Institute of Mental Health, women are particularly vulnerable to depression after giving birth, when hormonal and physical changes and the new responsibility of caring for a newborn can be overwhelming. Postpartum women are at an increased risk for depression for several months after childbirth (Munk-Olsen et al. 2006) and postpartum depression is most likely to occur within the first 30 months after giving birth. Stress or experiencing significant life events are common risk factors for

postpartum depression, which are factors that may be result from a partner's incarceration. Therefore, partner incarceration may increase the probability that mothers experience depression through its effect on postpartum depression. Although women in the comparison group are also new mothers, the significant experience of incarceration, coupled with the risk of postpartum after giving birth, may increase the likelihood that mother experience depression.

As it stands, however, the sample sizes are too small for me to discern whether the lack of robust estimates across years for depression and physical health are due to different true effects across the years, or simply due to lack of statistical power.

3.5 Conclusion

This chapter presents a preliminary investigation the effects of fathers' incarceration on the physical and mental health of mothers and the development outcomes of their young children. I estimate that having a partner that is recently incarcerated increases the probability that mothers experience depression by 3 percentage points in year 1 and increases the probability that mothers report being in good health by 6 percentage points in year 3. I do not find robust evidence for mother's health results across the three survey periods, however, perhaps due to small sample sizes. So while theyear 1 results for depression may be explained by a new mother's elevated risk of depression due to her postpartum status, I cannot conclude that definitively.. Among children whose fathers are incarcerated at age 5, paternal incarceration reduces PPVT test scores by 4 points and increases the aggression behavior index by 0.14. Anxiety/depression behavior, however, is not significantly related to paternal

incarceration. Wildeman (2010) and Geller et al. (2010) find similar results for the behavior outcomes. However, my results for verbal ability run counter to those of Geller et al. (2010), who find that verbal ability is not significantly related to paternal incarceration. I find no evidence of an incarceration effect on cognitive development or social behavior of children at age 3. This result is consistent with Geller (2009), with the exception that the authors find that paternal incarceration marginally significantly elevates the risk of aggressive behavior for children at age 3.

The results of this chapter, while not always robust, are suggestive enough to reinforce the importance of addressing specific challenges that may arise after a father becomes incarcerated, such as mental health issues and child behavior problems. A mother's mental health has direct implications for the wellbeing of her young children. For example, children of depressed mothers are more likely to experience adverse behavioral, social, and cognitive development outcomes from infancy through adulthood (Downey & Coyne, 1990; Goodman & Gotlib, 2002). Maternal depression is also linked to internalizing and externalizing behaviors problem in children (Meadows, McLanahan, & Brooks-Gunn, 2007, Turney 2010). Experiences during the early childhood development period have important implications for developmental trajectories into the adolescence years and adulthood. The findings of this chapter imply that intervention efforts should be directed towards mothers of young children upon fathers' incarceration, with specific attention given to the factors addressed in this analysis.

Table 3.1: Mean Characteristics of Baseline Sample and Year 1 Sample

	Baseline Sample	Year 1 Sample	
	Total	Father Incarcerated	Father Not Incarcerated
Demogrpahic Characteristics			
Mom Black	0.471	0.703	0.453
Mom Hispanic	0.272	0.196	0.271
Mom White	0.216	0.076	0.234
Mom Other	0.041	0.025	0.041
Parents of Diff. Race	0.151	0.120	0.150
Mom Foreign born	0.172	0.057	0.170
Mom Age	25.564	22.937	25.693
Mom <HS Education	0.329	0.506	0.303
Father Black	0.489	0.696	0.469
Father Hispanic	0.278	0.209	0.278
Father White	0.188	0.057	0.209
Father Other	0.045	0.038	0.045
Father Foreign born	0.146	0.032	0.157
Father Age	28.303	26.070	28.292
Father <HS Education	0.302	0.468	0.284
Other Characteristics			
Mom Number Kids	2.194	2.449	2.136
Mom HH Income	32501	17848	34485
Mom Poverty	0.354	0.582	0.326
Mom Public Assistance	0.358	0.532	0.346
Mom Govt. Housing	0.169	0.310	0.160
Mom lived with both parents at age 15	0.435	0.285	0.450
Mom smoke pregnancy	0.195	0.297	0.180
Mom alcohol pregnancy	0.108	0.108	0.103
Mom used drugs pregnancy	0.055	0.114	0.042
Mom-drinking/drugs interfered with daily life	0.030	0.057	0.024
Mom was treated drug/alcohol problems	0.042	0.101	0.031
Parents Married	0.253	0.032	0.281
Parents Cohabiting	0.372	0.405	0.388
Father Number Kids	1.890	2.032	1.916
Father Works	0.742	0.595	0.799
Father-drinking/drugs interfered with daily life	0.052	0.108	0.038
No. of Observations	4665	158	3607

Table 3.2: Mean Characteristics of Core and In Home Samples

	Year 3 In Home Survey			Year 5 In Home Survey		
	Participant	Non Participant	Paired t-statistics	Participant	Non Participant	Paired t-statistics
Father Incarcerated	0.086	0.052	-3.307	0.082	0.080	-0.267
Mom Black	0.489	0.456	-1.806	0.512	0.432	-4.575
Mom Hispanic	0.258	0.274	0.945	0.247	0.307	3.888
Mom White	0.217	0.224	0.427	0.213	0.208	-0.305
Mom Other	0.035	0.047	1.624	0.028	0.053	3.783
Parents of Diff. Race	0.143	0.164	1.623	0.134	0.166	2.593
Mom Foreign born	0.144	0.185	3.105	0.130	0.196	5.372
Mom Age	25.119	25.613	2.202	25.085	25.391	1.441
Mom <HS Education	0.339	0.321	-1.082	0.336	0.336	-0.039
Mom Number Kids	2.130	2.155	0.514	2.136	2.146	0.219
Father Black	0.510	0.464	-2.492	0.531	0.450	-4.694
Father Hispanic	0.264	0.282	1.120	0.250	0.315	4.253
Father White	0.190	0.197	0.479	0.187	0.184	-0.197
Father Other	0.036	0.056	2.852	0.032	0.051	2.843
Father Foreign born	0.129	0.168	3.091	0.114	0.172	4.997
Father Age	27.577	28.558	3.545	27.666	27.887	0.842
Father <HS Education	0.311	0.281	-1.780	0.315	0.297	-1.133
Father Number Kids	1.897	1.832	-1.345	1.892	1.853	-0.860
Parents Married	0.245	0.264	1.168	0.233	0.279	3.075
Parents Cohabiting	0.366	0.353	-0.732	0.359	0.366	0.404
No. of Observations	3252	939		2959	1140	

Table 3.3: Outcome Variable Means

	Father Incarcerated	Father Not Incarcerated
Child Outcome Variables		
PPVT	81.687	86.746
Aggression	0.676	0.577
Anxiety/Depression	0.476	0.405
Observations	99	1755
Mom Outcome Variables		
Good Health	0.870	0.931
Depression	1.168	0.939
Anxiety	0.404	0.269
Observations	161	3682

Table 3.4.1: OLS Results for Child Outcomes for the Year 3 Sample

Dependent Variable:	***PPVT***		***Aggression***		***Anxiety/Depression***	
Mean:	86.48		0.602		0.421	
Std. Dev.:	16.84		0.350		0.300	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	1	2	3	4	5	6
Father Incarcerated	-5.060**	-2.041	0.076	0.035	0.064**	0.018
	(2.100)	(2.004)	(0.047)	(0.043)	(0.027)	(0.031)
Father Black		-10.606***		0.045*		0.119***
		(1.358)		(0.022)		(0.018)
Father Hispanic		-9.408***		0.031		0.120***
		(1.327)		(0.030)		(0.019)
Father Other		-6.185**		-0.051		0.063*
		(2.705)		(0.041)		(0.031)
Father & Mom diff. Race		2.371**		0.009		-0.015
		(1.066)		(0.029)		(0.020)
Mom Age		0.318**		-0.003		-0.002
		(0.117)		(0.002)		(0.001)
Father Age		-0.115		-0.000		0.000
		(0.076)		(0.002)		(0.001)
Mom Foreign born		-4.487**		0.022		0.075**
		(1.866)		(0.045)		(0.034)
Father Foreign born		-2.264		-0.090*		-0.044
		(1.617)		(0.044)		(0.036)
Mom < HS Education		-2.064		0.039*		0.090***
		(1.220)		(0.021)		(0.025)
Father r< HS Education		-3.773***		0.056**		0.056**
		(0.932)		(0.022)		(0.024)
City Dummies		Yes		Yes		Yes
No. of Observations	1856	1856	1856	1856	1856	1856

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3.4.2: OLS Results for Mothers Outcomes for the Year 1 Sample

Dependent Variable:	***Good Health***		***Depression***		***Anxiety***	
Mean:	*0.929*		*0.119*		*0.024*	
Std. Dev.:	*0.258*		*0.324*		*0.153*	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
	1	2	3	4	5	6
Partner Incarcerated	-0.064	-0.051	0.035*	0.027	0.008	0.006
	(0.040)	(0.040)	(0.019)	(0.018)	(0.015)	(0.015)
Partner Black		-0.041***		0.001		-0.010
		(0.010)		(0.014)		(0.008)
Partner Hispanic		-0.044***		-0.010		-0.006
		(0.013)		(0.018)		(0.007)
Partner Other		-0.009		-0.019		-0.007
		(0.026)		(0.028)		(0.016)
Partner & Mom diff. Race		-0.006		0.020		0.012
		(0.010)		(0.017)		(0.007)
Mom Age		-0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
Partner Age		-0.001		-0.001		0.000
		(0.001)		(0.001)		(0.001)
Mom Foreign born		-0.026		-0.021		-0.001
		(0.016)		(0.015)		(0.010)
Partner Foreign born		-0.008		-0.004		-0.010
		(0.012)		(0.013)		(0.008)
Mom < HS Education		-0.053***		0.039**		0.013*
		(0.011)		(0.016)		(0.007)
Partner< HS Education		-0.030***		-0.001		0.006
		(0.010)		(0.012)		(0.005)
City Dummies		Yes		Yes		Yes
No. of Observations	3765	3765	3765	3765	3765	3765

Robust standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3.5.1: Probit Estimates of the Propensity Score for Children Sample
Dependent Variable: Father Recently Incarcerated in Year 3

Covariate	
Dad Black	0.023**
	(0.010)
Dad Hispanic	0.033
	(0.080)
Dad Other	-0.011**
	(0.005)
Dad & Mom diff. Race	-0.014
	(0.009)
Mom Age	0.000
	(0.001)
Dad Age	-0.001
	(0.000)
Mom Foreign born	0.006
	(0.012)
Dad Foreign born	-0.008**
	(0.004)
Mom < HS Education	0.007
	(0.008)
Dad < HS Education	0.026*
	(0.015)
Mom lived with both parents at age 15	0.001
	(0.005)
Mom access to family support	-0.001
	(0.010)
Mom Number of Kids	0.003
	(0.006)
Married/Cohabiting	-0.003
	(0.004)
Mom financial support pregnancy	0.007*
	(0.004)
Mom Medicaid	-0.001
	(0.004)
Mom government housing	0.002
	(0.004)
Mom smoke pregnancy	0.007
	(0.008)
Mom alcohol pregnancy	-0.001
	(0.005)
Mom used drugs pregnancy	-0.007**
	(0.003)
Mom – drinking/drugs interfered with daily life	0.013
	(0.020)

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Table 3.5.1: Continued

Covariate	
Mom treated drug/alcohol problems	-0.005
	(0.006)
Dad supported mom pregnancy	0.006
	(0.004)
Dad works	-0.001
	(0.004)
Dad other activities to generate income	0.008
	(0.006)
Dad physical/mental condition limits work	-0.004
	(0.004)
Dad – drinking/drugs interfered with daily life	0.007
	(0.010)
Mom safe neighborhood	-0.001
	(0.004)
Mom attends church	0.003
	(0.003)
Mom public assistance	0.005
	(0.004)
Month of pregnancy first visited doctor	0.001
	(0.001)
Mom considered abortion	-0.003
	(0.003)
Dad considered abortion	-0.003
	(0.003)
Mom good health	0.007**
	(0.003)
Dad good health	-0.000
	(0.004)
Child low birth weight	0.001
	(0.002)
Breastfed	-0.004
	(0.004)
Age at first birth	-0.000
	(0.001)
Mom HH Income Y1	0.000
	(0.000)
Mom Poverty Y1	0.005
	(0.005)

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Table 3.5.1: Continued

Covariate	
Food Insecurity Y1	0.002
	(0.006)
Housing Insecurity Y1	-0.000
	(0.004)
Utility Insecurity Y1	0.010**
	(0.004)
Mom work Y1	-0.011**
	(0.005)
Mom depressed Y1	0.000
	(0.004)
Mom anxiety Y1	0.003
	(0.011)
Mom smoke Y1	-0.007*
	(0.004)
Mom alcohol Y1	0.002
	(0.004)
Mom drugs Y1	-0.992***
	(0.003)
Mom drugs interfered with daily life Y1	-0.010***
	(0.003)
Mom was treated drug problems Y1	0.172
	(0.144)
Mom has access to cosigner Y1	0.000
	(0.003)
Mom has access to small loan Y1	0.003
	(0.004)
Mom has access to large loan Y1	-0.002
	(0.004)
Mom has bank account Y1	-0.002
	(0.004)
Mom has credit card Y1	0.000
	(0.004)

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 3.5.2: Probit Estimates of the Propensity Score for Mother Sample
Dependent Variable: Partner Recently Incarcerated in Year 1

Covariate	
Dad Black	0.017*
	(0.009)
Dad Hispanic	0.014
	(0.012)
Dad Other	0.034
	(0.031)
Dad & Mom diff. Race	-0.008
	(0.005)
Mom Age	0.002
	(0.002)
Dad Age	0.002
	(0.002)
Mom Foreign born	-0.005
	(0.008)
Dad Foreign born	-0.018***
	(0.005)
Mom < HS Education	0.003
	(0.005)
Dad < HS Education	0.013**
	(0.006)
Mom lived with both parents at age 15	-0.001
	(0.004)
Mom access to family support	0.005
	(0.009)
Mom Number of Kids	0.004**
	(0.002)
Married/Cohabiting	-0.007
	(0.005)
Mom works	0.001
	(0.005)
Mom financial support pregnancy	0.000
	(0.004)
Mom Medicaid	0.002
	(0.005)
Mom government housing	0.005
	(0.006)
Mom smoke pregnancy	0.004
	(0.006)
Mom alcohol pregnancy	-0.008
	(0.005)

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Table 3.5.2: Continued

Covariate	
Mom used drugs pregnancy	0.009
	(0.011)
Mom – drinking/drugs interfered with daily life	-0.004
	(0.010)
Mom treated drug/alcohol problems	0.056*
	(0.029)
Length of time mom knew dad	0.001***
	(0.000)
Dad supported mom pregnancy	0.010**
	(0.005)
Dad works	-0.010*
	(0.006)
Dad other activities to generate income	0.006
	(0.007)
Dad physical/mental condition limits work	-0.007
	(0.006)
Dad – drinking/drugs interfered with daily life	0.020
	(0.014)
Mom safe neighborhood	0.004
	(0.005)
Mom attends church	-0.005
	(0.004)
Mom public assistance	-0.005
	(0.004)
Month of pregnancy first visited doctor	0.001
	(0.001)
Mom considered abortion	0.006
	(0.005)
Dad considered abortion	-0.004
	(0.004)
Dad good health	-0.007
	(0.005)
Child low birth weight	-0.002
	(0.002)
Mom HH Income	-0.000*
	(0.000)
Mom Poverty	0.001
	(0.006)

Standard errors are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 3.6.1: Test of Balancing Property for Year 3 Child Sample

	Paired t Staitistics		Paired t Staitistics
Dad Black	0.4	Mom safe neighborhood	0.13
Dad Hispanic	-0.32	Mom attends church	0.52
Dad Other	0.05	Mom public assistance	0.21
Dad & Mom diff. Race	0.06	Month of pregnancy first visited doctor	0.77
Mom Age	-0.8	Mom considered abortion	0.25
Dad Age	-1.13	Dad considered abortion	-0.11
Mom Foreign born	-0.45	Dad good health	-0.31
Father Foreign born	-0.7	Child low birth weight	0.1
Mom < HS Education	0.12	Breastfed	-0.36
Dad < HS Education	0.2	Age at first birth	-1.08
Married/Cohabiting	-0.57	Mom HH Income Y1	-0.48
Mom Number of Kids	0.49	Mom Poverty Y1	0.57
Mom lived with both parents at age 15	-0.08	Food Insecurity Y1	-0.07
Mom access to family support	0.77	Housing Insecurity Y1	0.55
Mom good health	-0.29	Utility Insecurity Y1	0.57
Mom financial support pregnancy	1.3	Mom work Y1	-1.03
Mom Medicaid	0.51	Mom depressed Y1	-0.62
Mom government housing	0.68	Mom anxiety Y1	-1.11
Mom smoke pregnancy	0.46	Mom smoke Y1	0.32
Mom alcohol pregnancy	0.25	Mom alcohol Y1	0.25
Mom used drugs pregnancy	-0.41	Mom drugs Y1	-0.59
Mom – drinking/drugs interfered with daily life	-0.02	Mom drugs interfered with daily life Y1	0.59
Mom treated drug/alcohol problems	0.24	Mom was treated drug problems Y1	0.35
Dad supported mom pregnancy	0.69	Mom has access to cosigner Y1	0.08
Dad works	-0.93	Mom has access to small loan Y1	0.42
Dad other activities to generate income	1.05	Mom has access to large loan Y1	-0.36
Dad physical/mental condition limits work	-1	Mom has bank account Y1	-0.1
Dad – drinking/drugs interfered with daily life	-0.11	Mom has credit card Y1	-0.65

Table 3.6.2: Test of Balancing Property for Year 1 Mother Sample

Variable	Paired t Staitistics	Variable	Paired t Staitistics
Dad Black	-0.2	Mom used drugs pregnancy	0.84
Dad Hispanic	0.17	Mom – drinking/drugs interfered with daily life	1
Dad Other	0.34	Mom treated drug/alcohol problems	1.58
Dad & Mom diff. Race	0.2	Length of time mom knew dad	0.57
Mom Age	-1.05	Dad supported mom pregnancy	0.36
Dad Age	-0.42	Dad works	-0.89
Mom Foreign born	-0.16	Dad other activities to generate income	0.24
Father Foreign born	-0.5	Dad physical/mental condition limits work	0.18
Mom < HS Education	2.27	Dad – drinking/drugs interfered with daily life	0.55
Dad < HS Education	1.61	Mom safe neighborhood	-0.48
Married/Cohabiting	-1.59	Mom attends church	-0.65
Mom Number of Kids	0.25	Mom public assistance	0.28
Mom lived with both parents at age	-0.69	Month of pregnancy first visited doctor	0.38
Mom access to family support	-0.56	Mom considered abortion	0.26
Mom works	-1.68	Dad considered abortion	-0.79
Mom financial support pregnancy	0.74	Dad good health	-1.08
Mom Medicaid	0.86	Child low birth weight	0.64
Mom government housing	1.54	Mom HH Income	-2.54
Mom smoke pregnancy	0.48	Mom Poverty	1.99
Mom alcohol pregnancy	0.12		

Table 3.7.1: OLS and Matching Results of the Effect of Father Incarceration on the Development of Children
Treatment: Father Recently Incarcerated at Year 3 (Excluding Baseline and Year 1 Incarceration)

	Mean Outcome *Std. Dev.*	OLS Adjusted	Matching Results Epanechnikov Bandwidth=0.25	Tricube	Epanechnikov BW=0.30	Tricube
	1	2	3	4	5	6
Outcome Variables						
PPVT	83.798	-1.812	-1.155	-1.068	-1.260	-1.375
	15.670	(2.107)	(2.420)	(2.540)	(2.540)	(2.758)
Aggression	0.626	0.023	0.030	0.029	0.032	0.030
	0.358	(0.042)	(0.055)	(0.055)	(0.052)	(0.048)
Anxiety/Depression	0.463	0.019	0.031	0.031	0.031	0.026
	0.310	(0.037)	(0.038)	(0.034)	(0.035)	(0.038)
Observations		1019	1019	1019	1019	1019

Notes: All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). Standard errors clustered by city of residence (OLS) and bootstrapped standard errors with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Treatment: Father Recently Incarcerated at Year 5 (Excluding Baseline, Year 1, and Year 3 Incarceration)

	Mean Outcome *Std. Dev.*	OLS Adjusted	Matching Results Epanechnikov Bandwidth=0.25	Tricube	Epanechnikov BW=0.30	Tricube
	1	2	3	4	5	6
Outcome Variables						
PPVT	92.731	-3.751*	-3.996*	-3.815**	-4.066**	-3.987**
	15.553	(1.812)	(2.117)	(1.809)	(1.725)	(1.856)
Aggression	0.533	0.137***	0.147***	0.143***	0.152***	0.148***
	0.329	(0.046)	(0.046)	(0.042)	(0.052)	(0.044)
Anxiety/Depression	0.276	0.040*	0.029	0.027	0.031	0.030
	0.237	(0.021)	(0.022)	(0.022)	(0.021)	(0.021)
Observations		1066	1066	1066	1066	1066

Notes: All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). Standard errors clustered by city of residence (OLS) and bootstrapped standard errors with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3.7.2: OLS and Matching Results of the Effect of Partner Incarceration on the Physical and Mental Health of Mothers
Treatment: Partner Recently Incarcerated at Year 1 (Excluding Baseline Incarceration)

	Mean Outcome	OLS Adjusted	Matching Results			
			Epanechnikov	Tricube	Epanechnikov	Tricube
			Bandwidth=0.25		Bandwidth=0.30	
	1	2	3	4	5	6
Outcome Variables						
Mom Good Health	0.922	-0.047	-0.049	-0.048	-0.048	-0.048
		(0.037)	(0.037)	(0.038)	(0.038)	(0.034)
Depression	0.126	0.032	0.031*	0.031	0.031*	0.031*
		(0.028)	(0.017)	(0.019)	(0.018)	(0.017)
Anxiety	0.026	0.008	0.006	0.006	0.006	0.006
		(0.014)	(0.015)	(0.016)	(0.017)	(0.015)
Observations		2960	2960	2960	2960	2960

Notes: All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). Standard errors clustered by city of residence (OLS) and bootstrapped standard errors with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Treatment: Partner Recently Incarcerated at Year 3 (Excluding Baseline and Year 1 Incarceration)

	Mean Outcome	OLS Adjusted	Matching Results			
			Epanechnikov	Tricube	Epanechnikov	Tricube
			Bandwidth=0.25		Bandwidth=0.30	
	1	2	3	4	5	6
Outcome Variables						
Mom Good Health	0.854	0.055	0.060***	0.062***	0.062***	0.062***
		0.017	(0.021)	(0.260)	(0.019)	(0.019)
Depression	0.193	0.022	0.021	0.018	0.023	0.021
		(0.037)	(0.028)	(0.029)	(0.030)	(0.032)
Anxiety	0.046	0.000	-0.001	-0.002	-0.001	-0.001
		(0.019)	(0.016)	(0.017)	(0.017)	(0.015)
Observations		1727	1727	1727	1727	1727

Notes: All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). Standard errors clustered by city of residence (OLS) and bootstrapped standard errors with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3.7.2 (continued.): OLS and Matching Results of the Effect of Partner Incarceration on the Physical and Mental Health of Mothers
Treatment: Partner Recently Incarcerated at Year 5 (Excluding Baseline, Year 1 , and Year 3 Incarceration)

	Mean Outcome	OLS Adjusted	Matching Results			
			Epanechnikov	Tricube	Epanechnikov	Tricube
			Bandwidth=0.25		Bandwidth=0.30	
	1	2	3	4	5	6
Outcome Variables						
Mom Good Health	0.856	-0.049	-0.057	-0.052	-0.047	-0.044
		(0.034)	(0.041)	(0.056)	(0.045)	(0.045)
Depression	0.140	-0.022	-0.025	-0.023	-0.024	-0.024
		(0.039)	(0.037)	(0.041)	(0.036)	(0.037)
Observations		2219	2219	2219	2219	2219

Notes: All models include city of residence dummy variables. The matched sample is restricted to the region of common support, which is defined by the minimum and maximum estimated propensity score within the treatment group. OLS adjusted is the mean difference in public assistance participation between the treated and control groups of the corresponding sample, controlling for basic demographic characteristics (parent's race, age, and education). Standard errors clustered by city of residence (OLS) and bootstrapped standard errors with 200 replications (Matching) are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix Table 3.1: Child Behavior Checklist

Age 3

Aggressive Behavior

Can't wait turn
Defiant
Demanding
Destroys others' things
Disobedient
Does not feel guilty after misbehaving
Easily frustrated
Gets in fights
Hits others
Hurts animals or people without meaning to
Angry moods
Attacks people
Punishment doesn't change behavior
Screams a lot
Selfish or will not share
Stubborn, sullen, or irritable
Temper tantrums
Uncooperative
Wants a lot of attention

Anxious/Depressed

Clings to adults
Feelings are easily hurt
Too upset by separation
Looks unhappy
Nervous or high strung
Self-conscious or easily embarrassed
Too fearful
Looks sad

Age 5

Aggressive Behavior

Argues a lot
Brags or boasts
Cruel, bullying, or mean to others
Demands a lot of attention
Destroys his/her own things
Destroys things that belongs to others
Disobedient at home
Disobedient in school
Easily jealous
Gets in many fights
Physically attacks people
Screams a lot
Shows off
Stubborn, sullen, or irritable
Sudden changes in mood or feelings
Talks too much
Teases a lot
Has temper tantrums
Threatens people
Unusually loud

Anxious/Depressed

Complains of loneliness
Cries a lot
Fears s/he might think or do something wrong
Feels s/he has to be perfect
Feels or complains no one loves him/her
Feels others out to get him/her
Feels worthless or inferior
Nervous, high strung, or tense
Too fearful or anxious
Feels too guilty
Self-conscious or easily embarrassed
Suspicious
Unhappy, sad, or depressed
Worries a lot

Chapter 4

Conclusion

The dramatic rise in the male incarceration rate over the last several decades has led to an unprecedented number of fathers in prisons or jails in the U.S. Incarceration of thousands of fathers can have far reaching implications for children and mothers. This research addresses this issue by examining the causal effects of fathers' incarceration on various measures of wellbeing for mothers and children. In chapter 1, I estimate the effect fathers' incarceration on the public assistance participation of mothers with whom they share young children. Chapter 2 considers the effect of the incarceration of fathers on the development of children and the health of mothers. I employ propensity score matching techniques to address selection bias, exploiting the rich data availability in the Fragile Families and Child Wellbeing Study. This empirical method allows me to compare outcomes between children and mothers who share similar socioeconomic characteristics and differ only in terms of whether their father or partner has been recently incarcerated.

I find robust evidence that, among mothers with incarcerated partners, the incarceration of fathers increases the probability that mothers receive welfare and food stamp benefits, suggesting that a partner's recent incarceration may adversely affect the economic wellbeing of mothers. In terms of mothers' health, the results are less robust, although there is some evidence that is consistent with an increased risk of depression for new mothers whose partners become incarcerated. Among children whose fathers are incarcerated at age 5, paternal incarceration adversely affects child cognitive development as measured by the PPVT, and exacerbates aggressive behavior.

The implications of incarceration extend beyond those imprisoned; family members must also bear the economic and emotional burdens that may result from incarceration. Incarceration disproportionately affects families living in poverty, and the imprisonment of a family member may exacerbate hardships experienced by these families prior to incarceration. Many family members left behind after a family member's incarceration may experience challenges in a variety of areas, including economic wellbeing, mental health, and child development. My dissertation provides important insight into understanding the challenges experienced by the families of incarcerated fathers, particularly mothers and young children.

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Chapter 2

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