College of Business and Public Policy
University of Alaska Anchorage

Department of Economics Working Paper
WP 2023-02
July 2023

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July 11, 2023

Abstract

In this paper, I examine how the receipt of an unconditional cash transfer during pregnancy impacts maternal and infant health outcomes. Using linked birth certificate data, I apply a within-mother estimator to analyze how receipt of the Alaska permanent fund dividend (PFD), an annual cash transfer for all Alaska residents, affects the likelihood of being born preterm or low birth weight and the likelihood of experiencing complications at the time of labor and delivery. I find that receiving an additional $1,000 in PFD payment during the 12 months prior to birth decreases the likelihood of having a labor/delivery complication by approximately 12% and reduces the likelihood of being born very preterm by approximately 22%. The results are strongest for mothers with less than a high school education.

Keywords: cash transfers, maternal health, infant health, prenatal period

JEL Classification: I12, I38, J13

Acknowledgments: I would like to thank the Alaska Department of Health Analytics and Vital Records, particularly Richard Raines and Rosa Avila, for their help accessing and understanding the Alaska birth certificate data. I would also like to thank Brett Watson, Jim Murphy, Hannah Hennighausen, Kevin Berry, Alex James, Aaron Enriquez, Alexandra Edwards, and all of the attendees of the ISER brown bag seminar series for their incredibly helpful comments and feedback.

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1 Introduction

There is a rich economic literature analyzing the relationship between income and health (for example, Deaton, 2003, 2008; Grossman, 1972). A large subset of this work has focused in particular on the impact of income on health during pregnancy and early childhood given the critical impact of this period on lifelong economic and health outcomes (Almond & Currie, 2011; Currie, 2009). Broadly speaking, however, determining the causal impact of income on health can be difficult because of the many confounding variables, such as time trade-offs between work and health investments and socioeconomic status, as well as potential reverse causality. Alaska's annual permanent fund dividend, an annual payment to almost all Alaska residents of $918 - $3,644 (in 2016 USD), serves as a plausibly exogenous source of income to households in Alaska that can be used to better understand the causal effect of income on health. In this paper, I examine to what extent this exogenous variation in income during pregnancy can help to mitigate negative maternal and infant health outcomes.

Specifically, I examine how Alaska's permanent fund dividend payment impacts maternal health complications during labor and delivery and infant health outcomes at birth. Using a within-mother estimation strategy, I find that an additional $1,000 in the dividend payment during the 12 month period before the birth leads to a roughly 12% reduction in the likelihood of there being any labor and delivery complication as well as an approximately 22% decrease in the likelihood of a child being born very preterm (less than 32 weeks gestation). While there is some evidence of improved prenatal care use, the evidence for this pathway as a driving mechanism is modest.

Additionally, the universal nature of the Alaska PFD means that individuals of all income levels are eligible for the payment each year. All individuals who are eligible receive the same amount of money through the PFD and so, one would expect that lower income mothers would see a greater effect of the PFD payment. To test this hypothesis, I examine the effects of the PFD on health by education level of the mother, using education as a proxy for income as income is not reported in vital statistics. Consistent with this hypothesis, I find that the protective effect of the PFD is generally stronger for mothers with lower levels of education.

These findings contribute to our understanding of the widespread impacts of income on health. This is the first paper to estimate the impact of Alaska's permanent fund dividend on maternal health outcomes and one of only two other papers examining the impacts for infant health outcomes. Economics research examining the impact of income transfers on maternal health has shown positive impacts, but evidence is relatively limited. There is some evidence that the Earned Income Tax Credit (EITC), a major cash transfer program in the United States, reduces negative maternal health behaviors (Averett & Wang, 2013; Hoynes, Miller, & Simon, 2015) and improves maternal mental health (Evans & Garthwaite, 2014; Gangopadhyaya, Blavin, Braga, & Gates, 2020). Huang, Sherraden, and Purnell (2014) also find evidence that child development accounts improve maternal depressive symptoms. Outside the United States and Europe, conditional cash transfer programs such as the Janani Suraksha Yojana in India and the *Oportunidades* program in Mexico have shown strong evidence of increasing maternal use of health care (for example, Barber & Gertler, 2009; Lim et al., 2010; Powell-Jackson & Hanson, 2012). Aside from two studies showing that conditional cash transfers can reduce maternal depressive symptoms (Okeke, 2021; Powell-Jackson et al., 2016), however, there is a lack of work examining the effects on maternal health outcomes (Glassman et al., 2013; Hunter, Harrison, Portela, & Bick, 2017).

Impacts of cash transfers on infant health outcomes have been much more broadly studied. Almond and Currie (2011) summarize this literature on how resource shocks in utero impact infant and lifetime health outcomes, while Hoynes (2019) summarizes the specific impacts of the Earned Income Tax Credit. In addition to these summary articles, two papers have specifically examined the impact of Alaska's PFD on infant birth outcomes. Using a difference-in-differences specification, Chung, Ha, and Kim (2016) find that the introduction of the PFD in the 1980s led to a modest improvement in birth weight and APGAR scores. On the other hand, using outcome rates for aggregated demographic groups, a working paper from Wyndham-Douds and Cowan (2022) finds a detectable but very small negative effect of the PFD amount on several birth outcomes. The authors suggest that this negative effect may be due to unaccounted for selection into pregnancy and note that though negative the estimates are small enough that they are not "substantively meaningful." My approach differs from the previous work in that I examine the impact of the exogenously determined PFD amount on individual birth outcomes across siblings. This approach allows for me to hold time-invariant unobservable mother characteristics constant eliminating any possible bias from selection into fertility around the PFD based on these characteristics (Buckles & Hungerman, 2013; Cowan & Wyndham Douds, 2022). Consistent with the findings from Chung et al. (2016), my results show small reductions in the likelihood of being born low birth weight or preterm, though these results are not statistically significant. I also find a statistically significant reduction in the likelihood of being born very preterm, an outcome not examined in the other two papers.

This work also contributes to the broader policy discussion around high and rising United States maternal mortality rates and only slowly declining infant mortality rates. In the past two decades maternal mortality has more than doubled in the United States and infant mortality, while declining, is still roughly 75% higher than in other comparable OECD countries (Fleszar et al., 2023; Thakrar, Forrest, Maltenfort, & Forrest, 2018). Providing cash payments to mothers during pregnancy is one policy being considered in an attempt to curb these disturbing trends and reduce disparities in maternal mortality rates within the United States. Pilot programs have begun to explore this approach, but are still in the early stages–testing the policy in a controlled environment (California Preterm Birth Initiative, 2019; Erb, 2023; Nguyen, 2022; Philadelphia Board of Health, 2023). This paper contributes to this policy discussion by providing evidence for how broadly targeted cash transfer programs can impact maternal and infant health.

There are several pathways whereby this exogenous source of income may impact maternal and infant health. First, the cash transfer could have a direct impact through the additional income itself or the cash transfer could have a behavioral impact on how the recipient is spending their money through some sort of labeling effect. How Alaskans view and spend their permanent fund dividend each year is still an open question within the research, so I will focus here on the pathways connected to the direct impact of the dividend from the additional income itself. The impacts of this direct pathway can be broken down into three main categories, namely: increasing investments in health inputs, decreasing stress, and changing health behaviors.

First, additional income may allow for women to invest more in health inputs during the pregnancy period. The additional income could be used for general health inputs such as improved housing, purchase of medications, or direct health care use. Additional money could also be used for more pregnancy specific health inputs such as improving nutritional intake or increasing prenatal care use. Previous work has shown some evidence of higher PFD amounts leading to improvements in prenatal care use (Chung et al., 2016) as well as modest increases in infant birth weight. However, at least one study of the PFD found no evidence of increased food expenditures following the PFD suggesting that Alaskans may be smoothing consumption over this known source of income (Hsieh, 2003). There is some differing evidence from the EITC. Evidence from the EITC on prenatal care use is more mixed (Hoynes et al., 2015; Markowitz, Komro, Livingston, Lenhart, & Wagenaar, 2017), but there is evidence that the EITC leads to greater purchases of more food and healthier food supporting the increased nutritional intake pathway (Lenhart, 2019; McGranahan & Schanzenbach, 2013).

Other conditional cash transfer programs outside the US such as the Janani Suraksha Yojana in India or the Plan de Atención Nacional a la Emergencia Social in Uruguay have shown some improvements to maternal health inputs as a result of these types of incentive-based cash transfers. For example, many programs have reported improvements in the adequacy of prenatal care (Powell-Jackson & Hanson, 2012; Sosa-Rubi, Walker, Servan, & Bautista-Arredondo, 2011 and others) and increases in births with skilled attendants (de Brauw & Peterman, 2020; Lim et al., 2010; Urquieta, Angeles, Mroz, Lamadrid-Figueroa, &

Hernandez, 2009 and others). However, there is less evidence on how these programs may or may not translate into improved health outcomes for mothers.

This unconditional cash transfer could also reduce financial stress. Stress during pregnancy has been shown to have significant negative effects on infant health, including negatively impacting the main birth outcomes analyzed here, namely, low birth weight and preterm birth (for example, Aizer, Stroud, & Buka, 2016; Camacho, 2008; Currie & Rossin-Slater, 2013; Lindo, 2011). Stress during pregnancy can also have important health implications for mothers, for example, increasing the risk of developing hypertensive disorders such as gestational hypertension or preeclampsia (Coussons-Read, Okun, & Nettles, 2007; Garza-Veloz et al., 2017; Hosler, Nayak, & Radigan, 2011). These pregnancy-related health outcomes are known risk factors for many labor and delivery complications meaning that stress is also a likely pathway for impacting the primary maternal health measures examined here (Garovic et al., 2022).

Finally, additional income could impact maternal health behaviors such as smoking or drinking during pregnancy. If these types of products are normal goods, then increases in income from the PFD could increase the use of alcohol and other substances. There is some evidence of short-term increases in substance-abuse around the time of the PFD payment each year among the general public (Evans & Moore, 2011; Watson, Guettabi, & Reimer, 2020). On the other hand, additional income could reduce substance use if the money is instead used as an investment in maternal and infant health and smoking or other substance use is reduced. There is some evidence for this pathway from the Earned Income Tax Credit literature which suggests that the tax credit reduces maternal smoking (Averett & Wang, 2013; Hoynes et al., 2015; Strully, Rehkopf, & Xuan, 2010).

The rest of the paper is organized as follows. Section 2 provides a history and overview of Alaska's permanent fund dividend. Sections 3 and 4 provide details of the data used for analysis and the methodological approach, respectively. Results are presented in section 5 followed by robustness checks in sections 6. The paper closes with a discussion and conclusion in section 7.

2 The Alaska Permanent Fund Dividend

The Alaska Permanent Fund Dividend (PFD) is an annual cash transfer to all Alaskan residents regardless of age or income. The dividend payment comes from the Alaska Permanent Fund, which was established in 1976 from oil-revenue as a result of the discovery of the Prudhoe Bay oil reserve. The dividend program began in 1982 with the first $1,000 ($2,487 in 2016 dollars) payment dispersed between July and December of that year. Since that first payment, the Permanent Fund Dividend has been paid out every fall with amounts ranging from $918 to $3,644 in 2016 dollars.

The annual dividend amount is based on five-year average revenues from the Alaska Permanent Fund which creates consistency in size from year to year. While the initial capitalization of the Alaska Permanent Fund came from oil revenue, it is important to note that the fund itself is invested across diverse assets. Thus, the fund's revenue and the dividend payments do not co-move directly with Alaska economic or oil fluctuations.

Eligibility requirements for receiving the PFD are minimal. Individuals must be residents of Alaska for the entire qualifying year (the year prior to the year for which one is applying) and must intend to remain residents indefinitely. Also individuals must spend at least 180 days in Alaska and must not have been convicted of or incarcerated for a felony during the qualifying year. Infants born at any time during the qualifying year are eligible for the next year's PFD if they have an eligible Alaska resident sponsor.

Since 2000, when my analysis begins, the PFD has been dispersed every year in October (with the exception of 2008 when the PFD was paid one month early in September). The vast majority (91-96%) of payments from 2000 to 2012 were made using direct deposits so that most people received their payment on the exact date the PFD is dispersed. Figure 1 shows the annual per capita amount of the PFD in 2016 USD for the time period being analyzed. 2008 saw a particularly large PFD payment as the regular formulaic payment was supplemented by an additional $1,200 Resource Rebate, which was added to help Alaskans facing high energy costs that year. Otherwise the amount of the PFD follows the set formula and is based on the amount of the permanent fund's annual revenue. Important for the identification strategy being used, there is substantial variation in the amount of the PFD. Table 1, which presents summary statistics for the main variables, shows that on average there is a $900 difference in absolute terms in the amount of the PFD between births to the same mother.

3 Data

3.1 Birth Certificate Data

The primary source of data on maternal health comes from the state of Alaska Division of Public Health, Health Analytics and Vital Records birth certificate data. These data include the universe of births recorded in Alaska between 2000 and 2012 using the 1989 revision of the U.S. standard certificate for births. The main infant outcomes analyzed are indicators for low birth weight (<2500 grams), preterm (<37 weeks), and very preterm (<32 weeks). The main maternal health outcome of interest is the likelihood of experiencing a complication during labor and delivery. These are recorded in the "complications of labor and/or delivery" section of the birth certificate[1]. In addition to examining the likelihood of experiencing any complication, I also consider three specific labor/delivery complications particularly related to maternal health, namely: fever, premature rupture of the membrane, and excessive bleeding, which includes placenta abruptio, placenta previa, and other excessive bleeding.

[1] The checkbox options for this section of the birth certificate include: febrile (>100°F or 38°C), meconium (moderate/heavy), premature rupture of membrane (>12 hours), abruptio placenta, placenta previa, other excessive bleeding, precipitous labor(<3 hours), prolonged labor(>20 hours), dysfunctional labor, breech/malpresentation, cephalo pelvic disproportion, cord prolapse, anesthetic complications, fetal distress, none, and other.

From the birth certificate data, I also use information on the month of birth and estimated gestational age to determine when during the pregnancy the mother would have received the PFD. Encrypted mother ID numbers are included in the birth certificate data and are used to create mother fixed effects. Therefore, my main analysis examines differential outcomes across sibling births controlling for time invariant mother characteristics. Mother's age, mother's education, mother's marital status, child's birth order, and child's sex are considered as additional control variables in some specifications. Information on the timing of prenatal care initiation and the adequacy of prenatal care received during pregnancy are used to consider the health inputs mechanism.

I limit the data to singleton births to more easily control for birth characteristics as is common in the literature. I also drop births to teen mothers and mothers who are older than 50. I only include births after 2000 to more directly pinpoint the timing of the PFD payment through direct deposit, and I only include births before 2012 as Alaska switched to the 2003 revision of the U.S. standard birth certificate in 2013. Because I am including mother fixed effects in my main specifications, only mothers who have at least two births between 2000 and 2012 remain in the sample.

Table 1 presents summary statistics for the main outcome variables and several of the control variables from the birth certificate. In my sample, roughly 30% of births experience some complication at the time of labor and delivery. Individual labor and delivery complications are more rare, impacting 1-2% of births in the sample. 4% of the newborns in the sample weight less than 2500 grams at birth, 7% are born preterm, and 0.8% are born very preterm. There are on average 2.87 years between births to the same mother.

3.2 Alaska Department of Revenue PFD Reports

The Alaska Department of Revenue PFD annual reports provide information on the exact timing and amount of the PFD payment each year in per person terms. The nominal per person payment is adjusted for inflation and all values reported are in 2016 USD. Figure 1 presents a summary of the PFD payments for the years included in my analysis. The largest per person PFD payment was in 2008. The smallest PFD payment during this time period was in 2012. The average PFD payment amount between 2000 and 2012 was $1,838.86 per person. As can be seen in Figure 1, the amount of the payment is not monotonic, and there is considerable variation in the per capita payment throughout the period of study.

4 Methodology

To study the question of how the receipt of the PFD during pregnancy impacts maternal and infant health outcomes at the time of delivery, I employ two main strategies.

The first strategy considers only how the amount of the PFD in a given year influences maternal and infant health outcomes. The following equation estimates this impact.

For mother i, with child j, born in PFD year t:

$$Y_{ij} = \alpha + \beta AmountPFD_t + \gamma X_{ij} + \lambda_i + \varepsilon_{ij} \tag{1}$$

Here, Y_{ij} is a dummy variable for the maternal and infant health outcomes described in the data section, namely: any labor/delivery complication, fever, excessive bleeding, premature rupture of the membrane, low birth weight, preterm, and very preterm. The variable $AmountPFD_{ij}$ is a variable measuring the amount of the PFD payment that was distributed during the pregnancy period for birth j. X_{ij} is a set of birth specific and time-varying mother characteristic control variables. The set of controls used in the main specification include a quadratic for mother's age, mother's education, mother's marital status, child's birth order, child's sex, and annual oil prices. A linear time trend is also included. Finally, λ_i is a fixed effect for the mother, controlling for all time-invariant maternal characteristics.

The PFD payment is made to each individual Alaskan each year. The $AmountPFD_{ij}$ represents the per person amount paid out during that PFD year. Though every member of a family will receive a PFD payment if they are Alaskan residents, I do not take into account family size when calculating the $AmountPFD_{ij}$ variable. Family size is not exogenous to the PFD as previous work has shown fertility impacts of the PFD payment (Cowan & Wyndham Douds, 2022), nor is it orthogonal to the outcome variables. While scaling the PFD amount by family size would more accurately represent the monetary payment that individual families receive in a given year, it introduces bias into the estimator by reducing the exogeneity of the independent variable.

The second strategy considers how the timing of the PFD during pregnancy influences maternal and infant health outcomes. The following equation is used to estimate this relationship:

For mother i, with child j, born in PFD year t:

$$Y_{ij} = \alpha + \beta_1 Tri1PFD_{ij} + \beta_2 Tri2PFD_{ij} + \beta_3 Tri3PFD_{ij} + \gamma X_{ij} + \lambda_i + \varepsilon_{ij} \tag{2}$$

Y_{ij} is again a dummy variable for the maternal and infant health outcomes of interest. Each of the variables, $Tri1PFD_{ij}$, $Tri2PFD_{ij}$, and $Tri3PFD_{ij}$ are indicator variables for a mother i having received a PFD payment during the first, second, or third trimester prior to the birth of child j. X_{ij} is the same set of birth specific and time-varying mother characteristic control variables listed above. λ_i is a mother fixed effect. Standard errors are clustered throughout at the mother level.

5 Results

5.1 Baseline Results

Table 2 presents the results for the labor/delivery complication outcomes with the amount of the PFD as the independent variable as per equation (1). Columns (1), (3), (5), and (7) provide results for the simple mother fixed effects model without any additional controls. Columns (2), (4), (6), and (8) add controls for mother's marital status, education, and quadratic for age as well as child's birth order, child's sex, annual oil prices, and a linear time trend. The results show consistent evidence of greater PFD payments leading to improvements in maternal health. Results from the specifications with controls suggest that a $1,000 increase the PFD payment during the 12 months prior to birth leads to a 16% reduction in the likelihood of experiencing an intrapartum fever, a 15% reduction in the likelihood of excessive bleeding, a 21% reduction in the likelihood of premature rupture of the membrane, and an 12% reduction in the likelihood of facing any type of complication during labor and delivery.

The results for any complication while small are similar in magnitude to other policies that have been shown to impact labor and delivery complications. For example, Currie and MacLeod (2008) find that reform of the Joint and Several Liability rule reduced the likelihood of preventable complications (a subset of the complications included in my analysis) by roughly 13%. Using a slightly different list of preventable complications based on Italian Ministry of Health administrative data, Barili, Bertoli, and Grembi (2021) find fee equalization across c-section and vaginal births was associated with a roughly 2.6% decrease in the likelihood of experiencing a preventable complication. Given that I am using a more broad definition of any complication, making precise comparisons is not appropriate. These other works, however, provide some context for understanding the extent to which policies impact this type of outcome.

Table 3 presents the results using the secondary methodology with the indicator for trimester when the PFD was received as per equation (2). Results from Table 3 provide no strong evidence of the PFD impact being concentrated in any particular trimester of the pregnancy. While the coefficients are largest in magnitude during the third trimester for most specifications, the third trimester coefficient is only significantly different from the pre-pregnancy period for the outcome any complication and only significant at the 10% level. There are several reasons why there may not be strong evidence for differential impacts by trimester. First, the many channels whereby the PFD may impact maternal health outcomes at the time of labor and delivery are all likely to exert their impacts at different times during the pregnancy period. For example, initiating prenatal care in the first trimester is strongly recommended for supporting healthy pregnancies and is most likely to be impacted by the PFD if the PFD is received prior to or during the first trimester of pregnancy (American Academy of Pediatrics [AAP] and the American College of Obstetricians and Gynecologists [ACOG], 2017). On the other hand, attending third trimester prenatal care appointments can be important for catching early warning signs of risk factors for complications during labor and delivery such as infection or placenta previa (AAP and ACOG, 2017). Continued attendance at later pregnancy prenatal appointments may be most likely to be impacted by the PFD if the PFD is received later in the pregnancy, during the second or third trimester. Therefore, no clear dominant effects for any individual trimester may be a result of the PFD working through multiple channels.

A second reason for why there may be no strong differential impacts of the PFD based on time of receipt during pregnancy is that the PFD is an known source of income for Alaskans. Therefore, it may be that Alaskans are anticipating this source of income and smoothing their consumption across the year in line with the permanent income hypothesis. Evidence from research on the PFD and changes to consumption at the time of the transfer is mixed. Early research using Consumer Expenditure Survey data found no evidence of increased spending at the time of the PFD payment in line with the permanent income hypothesis (Hsieh, 2003). A more recent study using more detailed transaction level data, however, found substantial changes to non-durable consumption at the time of the PFD transfer (Kueng, 2018). These findings suggest that discount rates and credit constraints may create barriers to consumption smoothing leading to violations of the permanent income hypothesis. Additional studies provide further evidence that individuals change their consumption patterns at the time of the receipt of the PFD as well as other similar lump sum payments or in-kind transfers (for example, Evans and Moore (2011); Shapiro (2005); Stephens (2003); Watson et al. (2020)).

Table 4 shows similar protective effects of the amount of the PFD on the likelihood of being born very preterm. These results suggests that an additional $1,000 in the PFD payment leads to a 18-22% decrease in the likelihood of being born very preterm. There is also some weak evidence of a reduction in the likelihood of being born preterm though the result is not statistically significant at traditional levels with the controls are included and only represents about a 3-4% decline. There is no evidence of a significant impact on the likelihood of being born low birth weight. Results from Table 5 differ from the trimester level results for the labor and delivery complication outcomes. Here, there is some evidence that receiving the PFD in the first or second trimester compared to the three months prior to pregnancy, improves birth weight outcomes. The model suggests that receiving the PFD in the first or second trimester reduces the likelihood of a child being born with a birth weight below 2,500 grams by about 15%. There is not strong evidence for differential effects by trimester on the likelihood of being born preterm or very preterm.

5.2 Heterogeneity by Education

In addition to the baseline results, I also test for differential effects of the PFD by mother's education level. In table 6, I focus only on the results for any complication of labor and delivery. While mothers with more than a high school education still see a protective effect of the PFD, adding the interaction coefficient estimate for mothers with just a high school education or less than a high school education doubles the impact of the PFD. This results is consistent with the main hypothesis that lower income mothers are likely to see the greatest benefits from a program like this with a set amount of money given to all individuals. Results are generally consistent across the rest of the labor and delivery complication outcomes though there is no consistent story for the birth outcomes. These additional results can be found in the appendix figures A1 and A2, along with further heterogeneity tests based on race and urban/rural residence.

5.3 Prenatal Care as a Possible Mechanism

Using the birth certificate data, I also consider to what extent changes in early initiation and adequacy of prenatal care can explain the health improvements associated with receiving a higher PFD payment. I define early initiation of prenatal care as having begun prenatal care in the first trimester of pregnancy compared to having started prenatal care later in the pregnancy or having received no prenatal care. Adequacy of care is measured using the Kotelchuck index. It is defined in the regression analysis as a binary outcome with a value of one associated with receiving adequate or adequate plus care and zero meaning the mother received intermediate, inadequate, or no prenatal care during the pregnancy. It is notable that of those birth certificates where prenatal care measures are recorded, only 366 of the births in total are recorded as having received no prenatal care. Thus, these results are primarily an indicator of the intensive margin rather than the extensive margin.

The results of this analysis can be found in Table 7. I do find some evidence here that an additional $1,000 in the PFD payment improves the rates of early prenatal care initiation, as can be seen in column (1). The effect, however, is small. The coefficient of 0.0088 only constitutes about a 1% increase in the likelihood of receiving care in the first trimester. Notably, there is also not a significant increase in the likelihood of receiving adequate or adequate plus care as measured by the Kotelchuck index. The adequacy results are perhaps more telling as they incorporate both the timing of prenatal care initiation as well as number of total prenatal care visits for a given gestational length. Thus, while there may be earlier prenatal care initiation among births with a higher payment, there is no evidence of this translating to more adequate care overall.

Using the secondary methodology as per equation (2), there is evidence of an increase in the likelihood of early initiation and adequacy of prenatal care when the PFD payment is distributed during the three months prior to pregnancy or during the first trimester compared to receiving the payment during the final trimester of pregnancy. This result is consistent with some form of liquidity constraints preventing individuals from initiating prenatal care during the first trimester when payments aren't received until after the early initiation period of the pregnancy. Notably, the main results do not show a corresponding change in health outcomes except possibly for birth weight. There are two primary reasons for why we might see this change in prenatal care use but minimal evidence of corresponding change in maternal and infant health. First, it may be that the increase in the likelihood of receiving early and adequate prenatal care is not large enough to impact health outcomes. Given the mixed literature on the impacts of prenatal care on health outcomes at birth, this seems at least plausible (Corman, Dave, & Reichman, 2018). It is also possible that the reason there is no concentration of health impacts by trimester is because there are multiple pathways through which maternal and infant health are improving as a result of the PFD and these pathways are differentially effective at different periods in the pregnancy. In this case, differential health outcomes by trimester would not appear in the main regression results even if this improved prenatal care use translates to real improvements in health outcomes as other mechanism may be improving health outcomes primarily when the PFD is received in the second or third trimesters.

6 Robustness

In addition to the linear probability model, I also consider a logistic regression specification for all of the baseline results. I use a Logit regression model as a check of the linear probability model because all of the seven primary outcome variables are binary outcomes and several have relatively low means. The results are broadly consistent with the primary results.

Across all of the main specifications using methodology 1, the variable representing the amount of the PFD is defined as the most recent PFD payment prior to the birth of the child. One can consider an example based on the 2004 PFD payment to better understand how this specification defines the PFD amount for two children at the tail ends of the defined

PFD year. In the main specification, a child who is born on October 12, 2004 (the day of the PFD disbursement for 2004) and a child born on October 11, 2005 (the day before the PFD disbursement for 2005) would both be defined as having received $1,169 (the PFD payment amount in 2004). For the first child, the mother would have received that PFD payment on the day of the birth. For the second child, the mother would have received that PFD payment roughly three months prior to becoming pregnant. These are the extreme cases, as most mothers will have received that PFD payment during the pregnancy period. To be certain that these children born on the tail ends of the PFD year are not driving the results however, I redefine the relevant PFD in two ways.

First, I consider a specification where the relevant PFD is defined as the most recent PFD payment prior to the due date of the child. This alternative definition was chosen because the birth date of a child is related to the health of the mother and infant in utero. The due date serves as a proxy for the birth date while abstracting away from the possible endogeneity of birth timing. This definition provides an estimate that is closer to an intent to treat style estimate as some children who are born prior to their due date will be coded as having received a PFD amount that has not in fact been dispersed prior to their birth.

The second alternative PFD definition defines the relevant PFD as the most recent payment dispersed after the mother's last menstrual period for the given pregnancy. This definition suggests that the relevant PFD for a pregnancy is not necessarily the one dispersed prior to the birth of the child, but the one after the mother is pregnant. This definition is likely to be a more accurate depiction of the truly relevant PFD if individuals are able to smooth consumption using credit, allowing one to "spend" one's PFD money prior to the actual disbursement of the PFD.

Tables 9 and 10 provide results for all outcomes using these alternative definitions of the relevant PFD amount. For both alternative specifications, estimates and significance levels remain highly stable for all outcomes. These results are reassuring that births on the edge of the defined period for the relevant PFD are not driving the results.

7 Conclusion

The results of this paper suggest that universal cash transfers like the Alaska permanent fund dividend can have significant protective effects for maternal and infant health. I find that additional money in the form of a larger cash transfer results in a decrease in the likelihood of a mother experiencing an intrapartum fever, excessive bleeding, premature rupture of the membrane, or any of the labor/delivery complications noted on a birth certificate even after controlling for mother fixed effects. These affects are both statistically significant and economically meaningful, reducing the likelihood of these events by as much as 21% for premature rupture of the membrane. There is also some evidence of improvements in infant health with a roughly 20% decrease in the likelihood of being born very preterm for every additional $1,000 in the PFD payment, though there does not seem to be an effect on the likelihood of being born low birth weight. As hypothesized these protective affects were greater for mothers with less than a high school education.

Like all sibling comparison studies, one limitation of using the within mother strategy is that the sample is limited to only mothers who have had at least two children within the time period 2000-2012. Any women who have only one child are excluded from the study sample. In this setting, we may be worried that mothers who experience complications with their first child would be less likely to have subsequent children. While this type of selection shouldn't bias the within sample estimation, it suggests caution in extending these results to these out-of-sample women and infants.

Finally, the mechanisms driving these results are difficult to determine. Earlier prenatal care initiation may be a contributing factor though the overall contribution to the main impacts is likely to be modest given the small coefficient estimates. Further research into other potential pathways, such as nutritional intake and financial stress during pregnancy, is needed to fully understand how the PFD amount is impacting these maternal and infant health outcomes. New research on exactly how the PFD is being spent by households or how the PFD impacts mental health and stress-related outcomes would be particularly helpful for furthering our understanding of the possible mechanisms at play here.

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8 Tables and Figures

Table 1: Summary Statistics

	Mean	SD
PFD Amount	1838.86	776.35
Labor/Delivery Complication		
Bleeding	0.02	0.15
Any complication	0.29	0.45
Fever	0.01	0.10
PROM	0.02	0.14
Maternal Characteristics		
Mother's Age	27.96	5.23
Less than HS degree	0.09	0.29
HS degree	0.39	0.49
More than HS degree	0.44	0.50
Married	0.68	0.47
Birth Characteristics		
Share nonwhite	0.41	0.49
Birth order	1.68	1.68
Low Birth Weight	0.04	0.19
Preterm	0.07	0.25
Very Preterm	0.01	0.09
Years between births	2.87	1.73
Diff in PFD amount	-236.44	1164.59
Abs Diff in PFD amount	899.99	775.99
Female	0.48	0.50

Table 2: Amount of the PFD and maternal health outcomes

Dependent Variables:	Fever		Bleeding		PROM		Any complication	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Amount (in $1000)	0.0001	-0.0017***	-0.0036***	-0.0037***	-0.0026***	-0.0044***	-0.0221***	-0.0333***
	(0.0006)	(0.0006)	(0.0009)	(0.0009)	(0.0009)	(0.0009)	(0.0026)	(0.0027)
Fixed-effects								
Mother	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls		Yes		Yes		Yes		Yes
Fit statistics								
Mean	0.0105	0.0105	0.0239	0.0239	0.0207	0.0207	0.2872	0.2872
Observations	64,208	64,208	64,208	64,208	64,208	64,208	64,208	64,208
R^2	0.47150	0.47553	0.45732	0.45769	0.44597	0.44889	0.51085	0.52040
Within R^2	7.32×10^{-7}	0.00763	0.00041	0.00109	0.00024	0.00550	0.00191	0.02140

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Table 3: Trimester of the PFD and maternal health outcomes

Dependent Variables:	Fever		Bleeding		PROM		Any complication	
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Trimester 1 PFD	0.0024	0.0023	-0.0011	-0.0006	0.0010	0.0004	0.0082	0.0069
	(0.0016)	(0.0016)	(0.0023)	(0.0023)	(0.0022)	(0.0022)	(0.0065)	(0.0065)
Trimester 2 PFD	0.0026*	0.0023	0.0010	0.0019	0.0004	-0.0007	0.0040	0.0007
	(0.0015)	(0.0015)	(0.0022)	(0.0023)	(0.0021)	(0.0022)	(0.0063)	(0.0065)
Exp Trimester 3 PFD	-3.49×10^{-5}	6.11×10^{-5}	-0.0013	-0.0014	-0.0015	-0.0015	-0.0110*	-0.0107*
	(0.0015)	(0.0015)	(0.0022)	(0.0022)	(0.0021)	(0.0021)	(0.0063)	(0.0063)
Fixed-effects								
Mother	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls		Yes		Yes		Yes		Yes
Fit statistics								
Mean	0.0105	0.0105	0.0239	0.0239	0.0207	0.0207	0.2872	0.2872
Joint test p-value	0.1056	0.1940	0.6805	0.5179	0.6473	0.8121	0.0158	0.0558
Observations	64,208	64,208	64,208	64,208	64,208	64,208	64,208	64,208
R^2	0.47158	0.47548	0.45712	0.45751	0.44586	0.44855	0.51006	0.51852
Within R^2	0.00017	0.00755	3.97×10^{-5}	0.00075	4.38×10^{-5}	0.00489	0.00029	0.01755

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.
The joint test p-value is from an F-test of the joint nullity of all three trimesters.

Table 4: Amount of the PFD and birth outcomes

Dependent Variables:	Low Birth Weight (< 2500 grams)		Preterm (< 37 weeks)		Very Preterm (< 32 weeks)	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Amount (in $1000)	-0.0011	-0.0013	-0.0029**	-0.0021	-0.0014***	-0.0017***
	(0.0011)	(0.0011)	(0.0014)	(0.0015)	(0.0005)	(0.0005)
Fixed-effects						
Mother	Yes	Yes	Yes	Yes	Yes	Yes
Controls		Yes		Yes		Yes
Fit statistics						
Mean	0.0391	0.0391	0.0684	0.0684	0.0078	0.0078
Observations	64,093	64,093	64,004	64,004	64,004	64,004
R^2	0.51837	0.51981	0.53733	0.53883	0.46560	0.46683
Within R^2	2.52×10^{-5}	0.00302	0.00011	0.00336	0.00018	0.00249

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Table 5: Trimester of the PFD and birth outcomes

Dependent Variables:	Low Birth Weight (< 2500 grams)		Preterm (< 37 weeks)		Very Preterm (< 32 weeks)	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Trimester 1 PFD	-0.0055*	-0.0062**	-0.0032	-0.0041	-0.0005	-0.0005
	(0.0028)	(0.0029)	(0.0036)	(0.0036)	(0.0014)	(0.0014)
Trimester 2 PFD	-0.0047*	-0.0060**	-0.0048	-0.0066*	-0.0016	-0.0017
	(0.0026)	(0.0028)	(0.0034)	(0.0036)	(0.0012)	(0.0014)
Exp Trimester 3 PFD	-0.0026	-0.0020	-0.0028	-0.0021	-0.0015	-0.0014
	(0.0027)	(0.0027)	(0.0034)	(0.0034)	(0.0013)	(0.0013)
Fixed-effects						
Mother	Yes	Yes	Yes	Yes	Yes	Yes
Controls		Yes		Yes		Yes
Fit statistics						
Mean	0.0391	0.0391	0.0684	0.0684	0.0078	0.0078
Joint test p-value	0.1950	0.0828	0.5772	0.3235	0.4818	0.5117
Observations	64,093	64,093	64,004	64,004	64,004	64,004
R^2	0.51842	0.51989	0.53730	0.53885	0.46554	0.46673
Within R^2	0.00013	0.00318	5.62×10^{-5}	0.00341	6.26×10^{-5}	0.00230

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.
The joint test p-value is from an F-test of the joint nullity of all three trimesters.

Table 6: Amount of the PFD and labor/delivery complication by education

Dependent Variable:	Any complication
Model:	(1)
Variables	
Amount (in $1000)	-0.0203***
	(0.0040)
High School	0.0262*
	(0.0141)
Less than High School	0.0775***
	(0.0249)
Amount (in $1000) × High School	-0.0248***
	(0.0060)
Amount (in $1000) × Less than High School	-0.0303***
	(0.0098)
Fixed-effects	
Mother	Yes
Controls	Yes
Fit statistics	
Observations	59,467
R^2	0.54271
Within R^2	0.02482

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Table 7: PFD and prenatal care

Dependent Variables:	Early PNC	Kotelchuck Index Adequate or Better	Early PNC	Kotelchuck Index Adequate or Better
Model:	(1)	(2)	(3)	(4)
Variables				
Amount (in $1000)	0.0088***	0.0021		
	(0.0028)	(0.0035)		
Trimester 0 PFD			0.0317***	0.0212***
			(0.0065)	(0.0079)
Trimester 1 PFD			0.0183***	0.0155*
			(0.0070)	(0.0085)
Trimester 2 PFD			-0.0086	-0.0181**
			(0.0071)	(0.0085)
Fixed-effects				
Mother	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Fit statistics				
Observations	47,993	45,152	47,993	45,152
R^2	0.60293	0.65263	0.60356	0.65310
Within R^2	0.00697	0.00815	0.00854	0.00949

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Table 8: Amount of the PFD and birth outcomes (Logit Regressions)

Dependent Variables:	Fever	Bleeding	PROM	Any complication	Low Birth Weight (< 2500 grams)	Preterm (< 37 weeks)	Very Preterm (< 32 weeks)
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Amount (in $1000)	-0.2771*	-0.2833***	-0.4044***	-0.3144***	-0.0842	-0.0773	-0.4466***
	(0.1527)	(0.0720)	(0.0900)	(0.0274)	(0.0646)	(0.0495)	(0.1518)
Fixed-effects							
Mother	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	1,518	3,660	3,212	27,677	5,077	8,260	1,157
Squared Correlation	0.28016	0.07795	0.15787	0.11292	0.09920	0.08562	0.14477
Pseudo R^2	0.21951	0.06062	0.12154	0.08473	0.07478	0.06501	0.11686
BIC	6,389.7	15,702.7	13,822.9	145,713.6	23,325.4	39,269.5	4,566.4

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Table 9: Amount of the PFD based on due date and health outcomes

Dependent Variables:	Fever	Bleeding	PROM	Any complication	Low Birth Weight	Preterm	Very Preterm
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Exp Amount (in $1000)	-0.0017***	-0.0035***	-0.0041***	-0.0324***	-0.0018	-0.0022	-0.0016***
	(0.0006)	(0.0009)	(0.0009)	(0.0027)	(0.0011)	(0.0015)	(0.0005)
Fixed-effects							
Mother	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Mean	0.0105	0.0239	0.0207	0.2872	0.0391	0.0684	0.0078
Observations	64,208	64,208	64,208	64,208	64,093	64,004	64,004
R^2	0.47553	0.45767	0.44884	0.52031	0.51983	0.53884	0.46683
Within R^2	0.00763	0.00104	0.00542	0.02121	0.00306	0.00337	0.00248

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

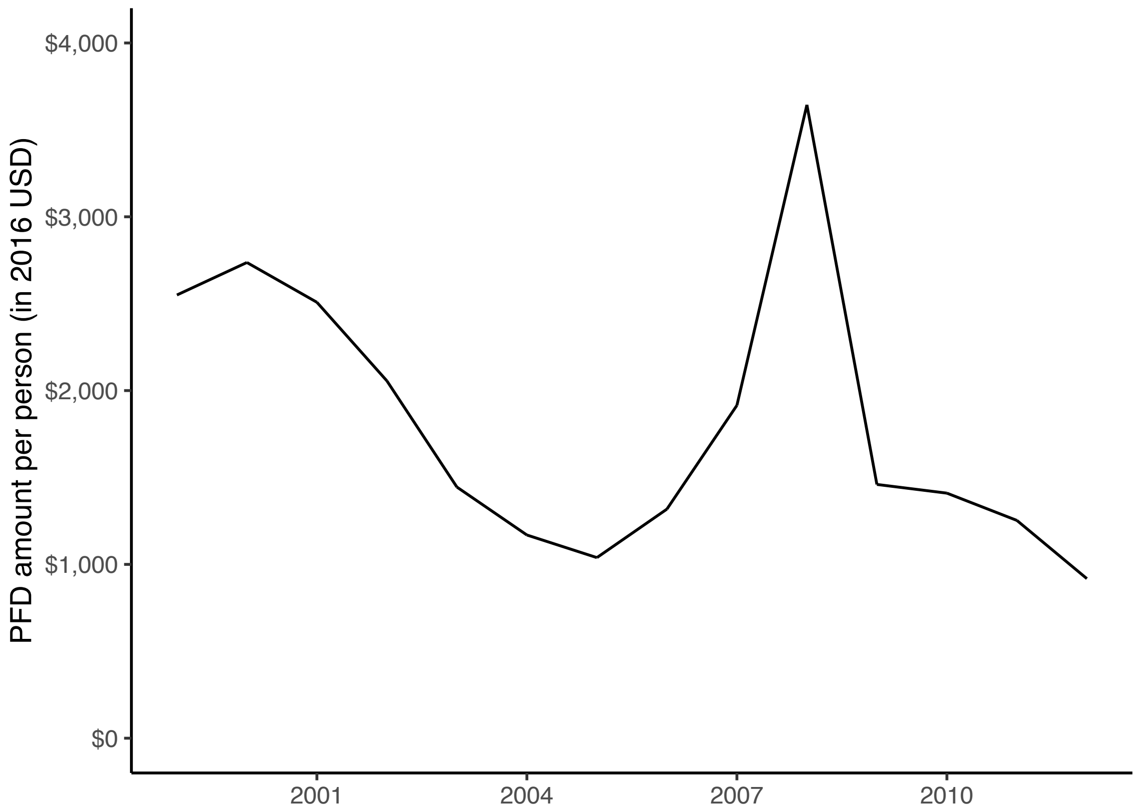
Table 10: Amount of the PFD based on last menstrual period and health outcomes

Dependent Variables:	Fever	Bleeding	PROM	Any complication	Low Birth Weight	Preterm	Very Preterm
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
LMP Amount (in $1000)	-0.0018***	-0.0034***	-0.0048***	-0.0330***	-0.0016	-0.0022	-0.0018***
	(0.0007)	(0.0010)	(0.0009)	(0.0029)	(0.0012)	(0.0016)	(0.0006)
Fixed-effects							
Mother	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Mean	0.0104	0.0238	0.0206	0.2866	0.0393	0.0689	0.0079
Observations	62,611	62,611	62,611	62,611	62,497	62,413	62,413
R^2	0.48280	0.47178	0.45547	0.52932	0.52586	0.54639	0.47492
Within R^2	0.00813	0.00107	0.00567	0.02095	0.00311	0.00341	0.00289

Clustered (Mother) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

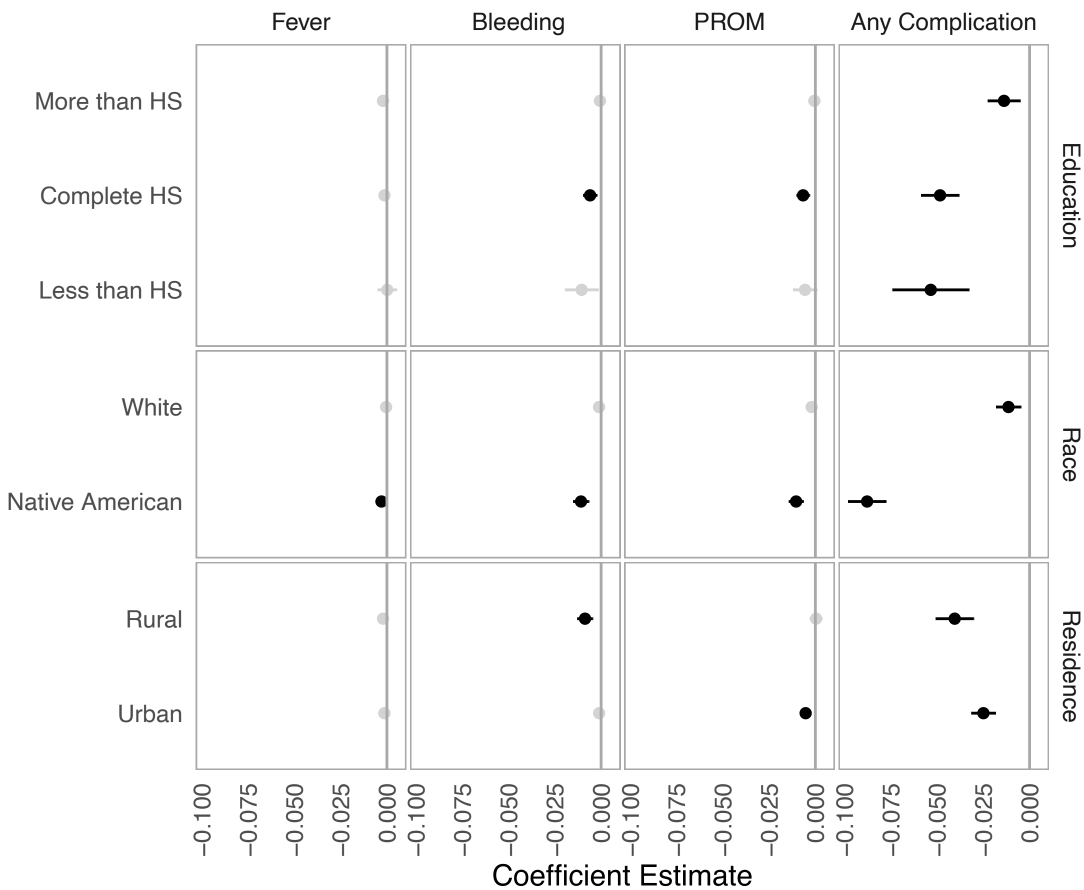
Notes: Controls include mother's education, quadratic age, and marital status as well as birth order, child's sex, annual oil price, and a linear time trend.

Figure 1: PFD Amount (2000-2012)



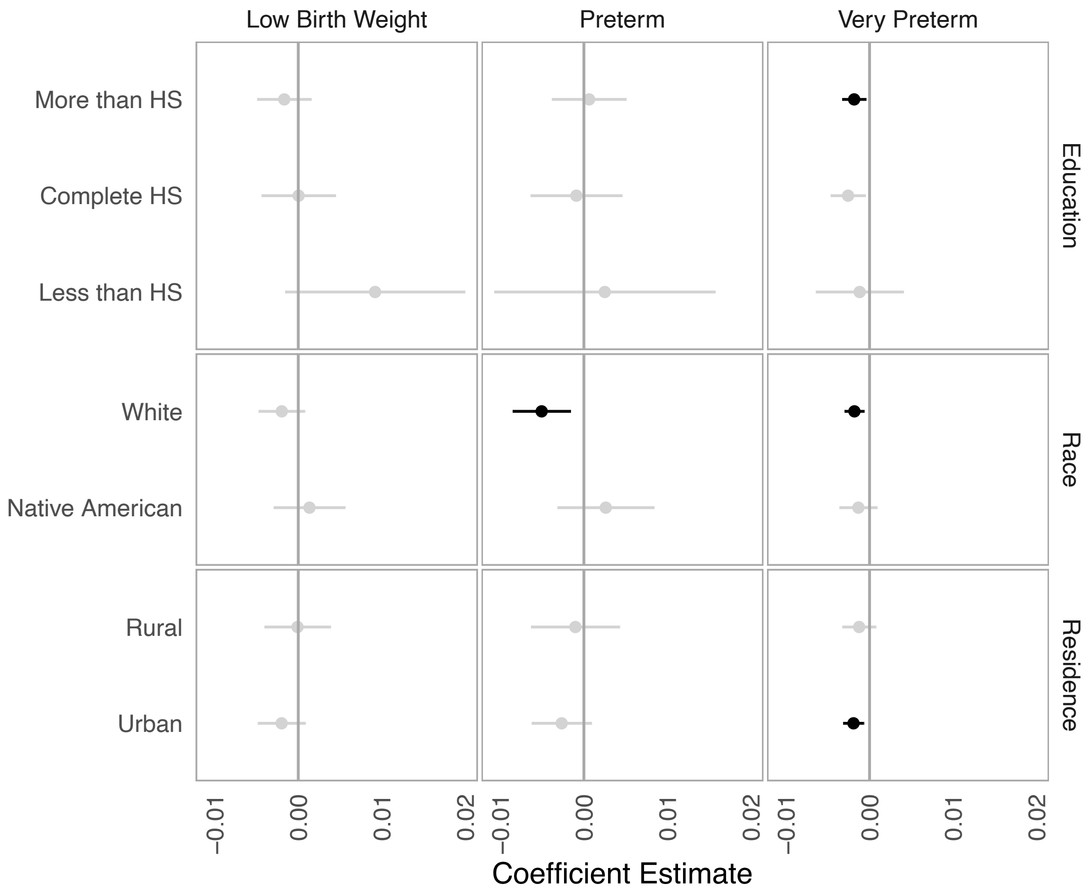
A Appendix Tables and Figures

Figure A1: Heterogeneity in Labor/Delivery Complication Impacts



Estimates in black are significant after the FDR or pFDP multiple hypothesis adjustment is made.

Figure A2: Heterogeneity in Labor/Delivery Complication Impacts



Estimates in black are significant after the FDR or pFDP multiple hypothesis adjustment is made.