Parental Responses to Child Support Obligations: Causal Evidence from Administrative Data*

Maya Rossin-Slater†

Miriam Wüst‡

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Abstract

We leverage non-linearities in Danish child support guidelines together with rich administrative data to provide causal estimates of parental behavioral responses to child support obligations. We estimate that a 1,000 DKK ($183) increase in a father's annual obligation is associated with a 507 DKK ($85) increase in his annual payment. However, we also show that an increase in the obligation reduces the likelihood that the father lives with his child, pointing to some substitution between financial and non-pecuniary investments. Further, we find that larger obligations are associated with higher new-partner fertility among both parents. The maternal fertility response is consistent with a positive income-fertility relationship, while the paternal fertility response may reflect increased demand for new offspring as a result of reduced contact with existing children. Finally, we find evidence that some fathers reduce their labor supply to avoid facing higher support obligations. Our findings suggest that government efforts to increase child investments through mandates on parents can be complicated by their behavioral responses to them.

JEL Codes: H4, I1, I3, J1, J2

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†University of California at Santa Barbara, Department of Economics. Contact e-mail: maya.rossin-slater@ucsb.edu

‡The Danish National Centre for Social Research (SFI). Contact e-mail: miw@sfi.dk

1 Introduction

Most modern governments engage in redistributive policies, whereby income is transferred from individuals who are taxed to individuals who receive benefits. The implicit "donors" and "recipients" under these policies usually do not have any direct connection, and a large body of research has examined the behavioral responses of these two groups *separately*. For instance, the ample literature on the elasticity of taxable income examines the behavior of donors, while the numerous studies on fertility and labor supply effects of welfare programs focus on the actions of the recipients.[1]

As a result of the sharp increase in the proportion of children growing up in single-parent households, a unique type of redistributive policy has evolved in the last several decades.[2] In the hopes of improving these children's financial circumstances and shifting the burden of their support from traditional welfare programs, governments mandate child support payments from non-custodial parents to the custodial parents and their children.[3] Under this redistributive policy, the donors (typically, fathers) have a clear connection to the recipients (typically, mothers and children). Thus, its impacts depend on both the recipients' and the donors' preferences and constraints, as well as their interactions with one another.

In this paper, we apply a novel identification strategy to rich administrative data from Denmark to estimate the causal effects of child support obligations on a wide range of parental behaviors, thus studying responses among *both* donors and recipients. Our empirical analysis is motivated by existing theoretical models (e.g., Weiss and Willis, 1985; Willis, 1999; Flinn, 2000) that highlight the intertwined nature of parental incentives and the complexity of their potential responses to child support obligations. These models demonstrate that child support obligations do not resolve the underlying collective-goods problem among separated parents, as custodial parents have full allocative power over how to spend the non-custodial parents' payments. As a consequence, non-custodial parents may view their obligations as taxes, which may not always benefit their children. Moreover, when the child support obligation is linked to the custody arrangement (e.g., if the

[1] For surveys of research on the elasticity of taxable income, see Gruber and Saez, 2002; Saez *et al.*, 2012; Piketty and Saez, 2013. For surveys of research on behavioral responses to welfare programs see Hoynes, 1997; Moffitt, 1998; Schoeni and Blank, 2000; Moffitt, 2002.

[2] In the U.S., 9 percent of children under age 18 lived with only one biological parent in the household in 1960, while over 26 percent do today. Many Western European countries have similar rates—for example, about 22 percent of British children, 18 percent of Danish children, and 15 percent of German children live with only one parent. Data for the European countries are from EU Community Statistics on Income and Living Conditions, 2007. Data for U.S. are from the 1960 Decennial Census and the 2013 Current Population Survey.

[3] Children in single-mother households are disproportionately low-income. In the U.S., children in single-mother households are twice as likely to live in poverty relative to the average child. In Denmark, children in single-mother households are three times more likely to live in poverty relative to the average child. For more information on child poverty rates in Europe, see: http://www.unicef-irc.org/publications/pdf/rc10_eng.pdf.

obligation is different depending on whether the parents share custody), it may affect parental decisions about child custody, as well as other voluntary and non-pecuniary investments and contact with children. These decisions may in turn have downstream effects on other parental behaviors, including family formation with new partners and labor market activities.

The existing evidence on the *causal* effects of child support obligations is limited. Researchers are faced with two main challenges. First, child support obligations are not randomly assigned, making it difficult to disentangle their causal effects from the possible influences of other (unobservable) differences between families. The second challenge stems from a substantial data constraint, especially in the United States, where most of the existing work has been set (see Garfinkel *et al.*, 1998; Del Boca, 2003; Lerman and Sorenson, 2003; Cancian *et al.*, 2011 for some surveys). Most U.S. data sets contain information on individuals in a given household, making it impossible to link children to their non-custodial parents. Additionally, much of the existing literature uses survey data with self-reported income measures, which may be missing or inaccurate for a significant fraction of respondents (Weinberg, 2006). Since child support obligations are largely determined by parental income, it is difficult to match non-custodial parents to their obligations. To our knowledge, no existing studies have exploited variation in child support obligations across individuals with different incomes.

This paper addresses the first challenge by using quasi-exogenous variation stemming from non-linearities in and changes to the child support guidelines in Denmark, where obligations are determined according to an annually updated step function of the non-custodial parent's income. Specifically, every year, all non-custodial parents under formal child support agreements are required to pay a base amount per child. Parents with incomes in certain ranges must also pay additional percentages (between 25 and 300 percent) of the base amount. The locations and spans of these income ranges change in every year, and vary with the non-custodial parent's number of children; the base amount is changed in every year as well.

We address the second challenge by taking advantage of administrative data on the universe of Danish children linked to their parents *regardless of their residence status* and with precise information on parental income. We are thus able to comprehensively analyze the effects of child support obligations on fathers' payments to children, fathers' likelihood of co-residence with their children, as well as both parents' post-separation family formation and labor market behavior.[4]

[4]Our analysis focuses on studying the effects of *fathers'* child support obligations because they are much more likely than mothers to become the non-custodial parents in case of separation. For example, according to Statistics Denmark, in 2010, about 26 percent of children lived with only one biological parent. Out of them, 23 percent lived with only their mothers or their mothers and their partners, while 3 percent lived with only their fathers or their fathers and their partners. While we observe information on whether the father lives with his child post-separation,

Our estimation strategy is analogous to the simulated instrumental variables (IV) approach of Dahl and Lochner (2012), who use expansions in the U.S. Earned Income Tax Credit (EITC) benefits—which have differentially impacted families with different incomes and different numbers of children—to identify the causal effects of family income on child outcomes.[5] In our setting, we start with data on all parents who divorce, separate, or have a child outside marriage or cohabitation over 1999-2008. For each father and in each year post-separation observed in the data, we predict the annual child support obligation he should face based on his income and number of children *measured in the year of separation.* Put differently, our predicted obligations are based only on post-separation changes to the child support guidelines, and do *not* take into account any changes to the father's income or number of children after separation, as these latter changes may reflect endogenous responses. We then use these predicted obligations to instrument for fathers' actual obligations.

Since the predicted obligation is a function of each father's separation year income, number of children at the time of separation, and the year of separation, all of our specifications control flexibly for the main effects and double interactions of these three variables. Causal identification therefore relies on an assumption that—conditional on the father's separation year income, number of children, and the year of separation—the remaining (policy-driven) variation in predicted child support obligations is orthogonal to other determinants of parental behaviors. In support of this assumption, we: (i) provide evidence that our predicted obligations are uncorrelated with a variety of parental characteristics that are not used in setting them (such as each parent's education, each parent's age, and maternal income), (ii) show that the predicted obligations do not impact selection into divorce, separation, or out-of-wedlock/cohabitation childbearing in the first place, (iii) show that our results are robust to predicting obligations using the father's income in the year *before* separation, which is arguably even more pre-determined than separation year income at the time of child support determination, and (iv) demonstrate that predicted obligations are uncorrelated with fathers' pre-separation labor supply behavior.

Our empirical results point to important parental behavioral responses to child support obligations. First, we show that child support obligations are moderately effective at increasing financial transfers from non-custodial fathers to children. Among all divorced and separated parents, a

we purposely do not drop these fathers since we show that residence with the child is an outcome that can be affected by the child support obligation.

[5]For another recent example of the simulated IV approach, see Milligan and Stabile (2011), who analyze the effects of Canadian tax benefits on child outcomes. This method is also broadly related to earlier work by Currie and Gruber (1996), who use policy-driven variation in economy-wide aggregate outcomes (rather than differential changes across sub-groups) to identify the effects of Medicaid on infant health.

1,000DKK ($183) increase in a father's average annual child support obligation is associated with a 507DKK ($85) increase in his average annual payment.

Next, we examine how the child support obligation affects the likelihood that a father ever resides with his child post-separation. In Denmark, parents who share equally in physical custody are not mandated to make child support payments; hence, a higher obligation may increase the incentive for the father to live with his child at least part of the time so to avoid making a larger payment. However, mothers, who have substantial say in custody decisions, have the opposite incentive to refuse to share custody and instead receive the higher payment. Moreover, fathers may treat financial transfers as substitutes for other forms of non-pecuniary investments and contact with children, which would also lead to a negative relationship between child support obligations and father-child co-residence. We find that these latter forces dominate in our data—an additional 1,000DKK in a father's average annual obligation leads to a 2.1 percent reduction in the likelihood that he resides with his child in at least one year post-separation.

We also analyze parental fertility responses. We find that a 1,000DKK increase in the father's average annual child support obligation leads to a 3.2 percent increase in the likelihood that the mother has an additional child post-separation, consistent with a positive income-fertility relationship documented in other studies analyzing child tax and welfare benefits in Western Europe and Canada (Laroque and Salanié, 2008; Brewer *et al.*, 2012; Milligan, 2005).

Fathers face unique fertility incentives in our context. First, our result on father-child co-residence suggests that an increase in the father's obligation may lead to less attachment to his existing children and more time available to invest in new offspring. Second, due to non-linearities in the child support guidelines and the fact that the per-child obligation is set according to the father's total number of children (including those born within subsequent unions) but only applies to his non-custodial children, some fathers can reduce their obligations by having more children within unions with new partners. We find evidence consistent with these positive fertility incentives: a 1,000DKK increase in a father's average annual obligation increases his likelihood of having a subsequent child by 3.7 percent. This effect is driven by fathers having children while married to or cohabiting with new partners, and by fathers who do not reside with their older children.

Finally, we find that fathers change their labor market behavior in response to child support obligations, while mothers do not. Overall, a 1,000DKK increase in a father's average annual child support obligation reduces his labor force participation by 0.2 percent. This average treatment effect masks important heterogeneity, however. Fathers with separation year incomes in the lowest income range, who must all pay the same lump-sum base amount, actually increase their labor supply. In

contrast, fathers with separation year incomes in higher ranges—who must make supplemental payments and thus face a competing incentive to reduce their earnings—are the ones driving the decline in labor force participation. This labor supply decline reflects transitions into disability insurance and discretionary early retirement programs. As such, we provide additional support for the relationship between the relative value of labor market participation and the take-up of these programs, which has been previously documented both in Scandinavia (Bratsberg *et al.*, 2010; Bingley *et al.*, 2011) and in the U.S. (Black *et al.*, 2002; Autor and Duggan, 2003).

Our findings suggest that government interventions into families with divorced and unmarried parents result in important parental behavioral changes that can distort their intended impacts on child investment levels, public spending, and overall child well-being. While fathers respond to child support obligations with increased financial transfers to their children, they also reduce their contact with them. Moreover, the increases in both parents' subsequent fertility rates point to possible reductions in the allocation of resources toward the existing children whom child support guidelines are meant to help. Finally, the decreases in paternal labor supply among higher-income fathers demonstrate the market distortions generated by the "tax-like" nature of child support mandates. Our results suggest that although child support mandates may shift some of the cost of single-mother household support from welfare programs to the non-custodial fathers, they also pass part of this cost on to other government programs such as disability insurance and early retirement. In sum, our results highlight the role of parental agency in family resource allocation, and suggest that government efforts to increase child investment levels through mandates on parents can be complicated by their behavioral responses to them.

The rest of the paper unfolds as follows. In Section 2, we describe the Danish child support system, which is crucial for understanding our identification strategy. Section 3 outlines a set of hypotheses (with a more formal model presented in Appendix B) to highlight the channels through which fathers' child support obligations could affect parental behaviors, and summarizes the existing evidence on child support. Section 4 describes our data, while Section 5 presents our empirical strategy. Section 6 presents our results and a variety of robustness tests, and Section 7 concludes.

2 The Danish Child Support System

In Denmark, a central government body called the State Administration (*Statsforvaltningen*) handles all issues related to divorce, separation, and child support. Parents who have sole physical custody of their children can request a formal child support agreement from this agency, which

then assigns child support obligations to the non-custodial parents. Child support obligations apply to all previously married, previously cohabiting, and never-married/non-cohabiting parents.[6] The non-custodial parent must start payments in the year when he no longer lives with his children (i.e., married parents who separate do not need to wait until they are divorced). As noted above, throughout this paper, we focus on the effects of non-custodial *fathers'* child support obligations; thus, from here on, we refer to fathers as the default non-custodial parents.

A non-custodial father must make monthly payments directly to the custodial mother, and if he does not comply with his obligation, the mother can inform the State Administration, which then issues reminders.[7] In case of further non-compliance, the tax authorities can withhold non-custodial fathers' tax benefits and refunds, as well as seize their assets.

Child support obligations are determined according to a formula that is a step function of the father's current gross income; this step function changes every year and varies with the father's number of biological children under age 18, including any new children from subsequent marriages or unions. For example, a father with one non-custodial child and one child from a new union is treated as a two-child parent (although he only has to make payments for the non-custodial child).

The per-child obligation consists of a "normal amount" and an "extra amount," the sum of which all non-custodial fathers must pay.[8] Non-custodial fathers with incomes above certain thresholds must also pay an additional percentage of the normal amount that ranges between 25 and 300 percent. The locations of the thresholds are increasing with the number of children.[9] Moreover, in every year, the State Administration has increased both the normal and extra amounts above the rate of inflation, and has changed the locations of the thresholds.[10] As an example, Appendix

[6]The only distinction is that among previously married couples, paternity of the ex-husband of the mother is presumed and does not need to be established. Among previously cohabiting or never-married/non-cohabiting parents, the parents can either sign a "Declaration of Care and Responsibility" form if they wish to share custody, or the father can sign an "Acknowledgement of Paternity" form if the parents do not want to share custody. If neither form is signed, then the mother is required to designate a father on the child's birth certificate, and a DNA test is ordered to confirm paternity. As such, almost all children have a legal father, who is obligated to make child support payments if the mother establishes a formal child support agreement. See http://www.york.ac.uk/inst/spru/research/childsupport/denmark.pdf and Skinner *et al.* (2007) for more details.

[7]Only non-custodial fathers who are on social assistance and under a formal agreement have child support payments automatically deducted from their benefits and transferred to the mothers by the municipality government. As described in Section 4, our analysis sample consists of relatively higher-income fathers who are very unlikely to qualify for social assistance.

[8]The extra amount was introduced in 2000 and has varied from 1,224DKK ($221) to 1,270DKK ($230) per child per year during our analysis time frame.

[9]For example, the first income threshold was at 275,000DKK ($50,263) for one-child families and at 290,000DKK ($53,003) for two-child families in 1999, meaning that two-child fathers with incomes slightly above 275,000DKK were ordered to pay less per-child relative to one-child fathers.

[10]According to the State Administration, these changes in the child support formula are meant to follow average wage development in Denmark.

Table 1 depicts the child support scheme for three of our analysis years: 1999, 2005, and 2008.[11]

The structure of the child support formula leads to substantial non-linear variation in the child support obligations faced by non-custodial fathers depending on their incomes, their numbers of children, and the year: 1) in the same year, non-custodial fathers face different obligations depending on their incomes and numbers of children, 2) at the same amount of real income, non-custodial fathers face different obligations depending on the year and number of children, and 3) non-custodial fathers with the same number of children face different obligations depending on their incomes and the year. This variation is displayed in Figures 1 and 2, which plot the annual child support obligations in real year 2000 DKK for parents with one and two children, respectively, and in Appendix Figures 1 and 2, which plot the annual child support obligations for these parents in nominal amounts.[12]

Notably, the guidelines have changed such that, over different time periods, fathers in some income ranges have experienced increases in real annual obligations, while fathers in other income ranges have experienced decreases. For example, fathers with real incomes below 275,000DKK ($50,199) have seen an increase in real obligations in each year over 1999-2008; fathers with real incomes around 300,000DKK ($54,762) experienced a decrease over 1999-2001 and then an increase over 2001-2008; while fathers with real incomes around 350,000DKK ($63,889) witnessed an increase over 1999-2002, a decrease over 2002-2003, an increase over 2003-2005, a decrease over 2005-2006, an increase over 2006-2007, and a decrease over 2007-2008. The magnitudes of these increases and decreases are different across time periods, income ranges, and the number of children. In our main analysis sample, real annual child support obligations have ranged between 9,395DKK ($1,705) and 42,136DKK ($7,649), representing between 3 and 15 percent of fathers' annual real gross incomes.[13]

Finally, while most parents seek government intervention in determining child support payments—for example, in 2006, 75 percent of divorced and separated parents had a formal child support

[11] Information on annual child support guidelines comes from the State Administration. For more information, please see http://www.statsforvaltningen.dk/site.aspx?p=6404.

[12] As noted above, non-custodial fathers must make their payments on a monthly basis. However, since our data is at an annual level, we aggregate the obligation amounts to the annual level as well.

[13] In the U.S., states follow either the "Income Shares" or the "Percentage of Income" formula in determining child support obligations. Under the "Income Shares" formula, non-custodial parents have to pay a share of the net *joint* income of both parents: between 18 and 24% for families with one child and between 28 and 37% for families with two children. The "Percentage of Income" formula only considers the non-custodial parent's gross income (as in Denmark): non-custodial fathers have to pay 17% of gross income if they have one child and 25% if they have two children. See Garfinkel *et al.* (1994) for more information. While these obligations represent higher percentages of non-custodial fathers' incomes than those in Denmark, it should be noted that non-compliance rates are quite high in the U.S. According to data from the 2010 CPS Child Support Supplement, 41% of custodial mothers with formal child support agreements reported receiving all the child support that was due in the previous year.

agreement through the State Administration[14]—not all do. First, child support guidelines do not apply to parents who equally share physical custody of their children (i.e., there are no child support obligations for either parent). Second, some parents opt for an informal agreement. Although those parents do not face direct and enforced mandates from the government, the annually updated child support schedule—which is posted both on the Internet and at the State Administration office—may serve as a guide for their voluntary payments. Custodial mothers can always seek a formal agreement if the non-custodial fathers' voluntary payments do not match the suggested amounts stated in the guidelines. Furthermore, non-custodial fathers have strong incentives to make payments: most of the child support paid up to the amount specified by the guidelines, regardless of whether it is paid under a formal agreement or not, is tax-deductible.[15]

While these factors encourage many non-custodial fathers to follow the State Administration's child support guidelines, it is clear that the guidelines form the basis for a majority, but not all, of the divorced and separated fathers' child support payments. However, since we cannot identify formal agreements and observe physical custody arrangements imperfectly in our data, our empirical analysis identifies the effects of government-mandated formal child support obligations on *all* divorced and separated parents. We discuss this issue further in Sections 4 and 5.

3 Hypotheses and Existing Evidence

3.1 How Might Child Support Obligations Affect Parental Behaviors?

This section describes the channels through which non-custodial fathers' child support obligations could affect parental behaviors after separation.[16] We present a more formal theoretical framework in Appendix B, drawing on several existing models of interaction within non-intact families (e.g., Weiss and Willis, 1985; Del Boca and Flinn, 1995; Willis, 1999; Flinn, 2000; Del Boca and Ribero, 2003; Roff and Lugo-Gil, 2012).

[14]See http://www.york.ac.uk/inst/spru/research/childsupport/denmark.pdf and Skinner *et al.* (2007) for more details.

[15]Only the extra amount—i.e., the first 1,224DKK ($221) to 1,270DKK ($230) per child per year—is not tax-deductible. The value of the deduction amounts to a compensation for around one third of the payment.

[16]Child support obligations, which, in theory, make separation and family formation more costly for non-custodial fathers and increase custodial mothers' bargaining power, may also influence the rates of divorce and separation among parents who are still together, as well as the rates of childbearing outside marriage and cohabitation among men and women who are not yet parents (Brown and Flinn, 2011). Other policies, such as unilateral divorce laws and joint custody reforms, which aim to affect the outcomes of families with divorced and unmarried parents, have been shown to also impact divorce and marriage rates (Stevenson and Wolfers, 2006; Wolfers, 2006; Halla, 2013). Such effects can complicate the study of outcomes among separated parents because of bias due to the treatment (in our setting, the child support obligation) being correlated with selection in or out of the sample of analysis. However, this issue is not empirically relevant in our context. As discussed in detail in Section 5, we find no relationship between child support obligations and the likelihood of parental separation in our data.

The thought experiment behind our empirical analysis is to ask: What is the effect of a 1,000DKK increase in a father's child support obligation, holding all else equal? We begin our analysis by studying child support payments. A father who always perfectly complies with his obligations will increase his payment one-for-one (i.e., by 1,000DKK exactly). However, a father who would have made a supplemental voluntary payment if the obligation were lower may just substitute the formal payment for his voluntary transfer, implying a less than one-for-one increase in payments. Additionally, a father may respond to the increase in the obligation by adjusting other post-separation behaviors (as discussed next). These behavioral responses will in turn affect his subsequent obligations (and, therefore, his payments), also leading to a less than perfect correlation between obligations and payments.

Next, we ask whether increasing the child support obligation affects father-child contact. Our administrative data contain only one measure of contact—we observe whether fathers live with their children for at least some time post-separation. The predicted impact of increased obligations on father-child co-residence is theoretically ambiguous: On the one hand, since fathers who share in physical custody are not required to pay any child support, a higher obligation may incentivize father-child co-residence. On the other hand, the mother—as the potential recipient of the higher obligation—has the opposite incentive to refuse to allow father-child co-residence.[17] Furthermore, father-child contact may be influenced through the child quality function. If parental financial and time investments are complements, a higher obligation will increase the return to the father's time spent with his child. If, instead, financial and time investments are substitutes, then a higher obligation may encourage the father to substitute away from time spent with his child.

We then study both parents' post-separation fertility. For a mother, an increase in the father's obligation generates a positive income shock, which may increase her demand for subsequent children (assuming that child quantity is a normal good). Analogously, an increase in the obligation represents a negative income shock for the father, which may decrease his demand for subsequent children. However, there are at least two additional channels that generate a positive effect on the father's post-separation fertility. First, since a higher obligation can reduce contact with his existing children, the father may have higher demand for additional children with new partners and more time to invest in these new offspring. Second, since the thresholds in the Danish child

[17] In practice, parents can either agree on a custody arrangement or go to the court if they are unable to reach an agreement. Hence, if the mother refuses to share physical custody, the father can in principle take the issue to court. However, prior to a reform in October 2007, which made joint legal custody the default determination (and hence made joint physical custody more likely as well), courts were likely to rule in favor of maternal sole custody. Thus, it is reasonable to assume that, during our sample time frame of 1999-2008, mothers had substantial influence over the custody decision.

support step function are increasing in the number of biological children, and since the father must only make payments to existing non-custodial children, some fathers can reduce their obligations by having additional children in new unions.[18]

Finally, we study both parents' labor market outcomes. Fathers face heterogeneous labor supply incentives. For a father with an income below the first threshold in the child support step function, an increase in the obligation is a flat negative income shock, which should reduce demand for leisure and increase labor supply. In contrast, a father with an income above the threshold faces a type of tax on earnings. He has an incentive to lower his labor supply to reduce his earnings and avoid paying the additional child support amount. For a mother, an increase in the obligation is a positive income shock that is independent of her own earned income. As such, we may expect an increase in maternal demand for leisure and therefore a reduction in her labor supply.

In sum, the question of parental behavioral responses to child support obligations is complex and with several theoretically ambiguous predictions; it is ultimately an empirical question. Below, we review the existing evidence on this question, and then proceed to describe our own analysis.

3.2 Existing Evidence on Child Support

There are two strands of existing literature on issues related to child support, both focused on the U.S. setting. One strand has used a structural model approach to directly estimate parameters of utility functions among separated parents (see, e.g., Del Boca and Flinn, 1995; Flinn, 2000; Del Boca and Ribero, 2003; Brown and Flinn, 2011; Roff and Lugo-Gil, 2012; Tartari, 2014). This approach is also useful for generating predictions about the impacts of various policy counterfactuals (e.g., perfect institutional enforcement of child support obligations versus weak enforcement). As with all such structural estimations, however, functional form assumptions and concerns about endogeneity present some limitations.

We take a complementary approach by using quasi-exogenous variation in an existing policy (namely, the Danish child support guidelines) and studying the reduced-form impacts of child support obligations on a wide range of parental behaviors. While our results cannot directly speak to parental preferences or overall welfare, our analysis instead focuses on producing *causal* estimates.

[18] We should also note that there are differential incentives for mothers' and fathers' subsequent fertility *outside* marriage and cohabitation. In particular, although a father may lower his per-child obligation by having more children, fertility within unions is more attractive than fertility out-of-wedlock/cohabitation, since he is only subject to the child support obligation for his non-custodial children. By contrast, relative to the father, a mother may have a larger incentive to have subsequent children out-of-wedlock/cohabitation as receipt of a higher payment for her existing children may increase her expectation of child support payments associated with subsequent offspring from new partners.

We thus more directly contribute to the other strand of existing literature on child support, which uses variation across U.S. states in child support enforcement spending or the implementation of specific policies (such as automatic wage withholding) to identify their effects. Several such studies have shown that child support enforcement policies and spending are correlated with higher child support payments (Sorensen and Halpern, 1999; Freeman and Waldfogel, 2001; Sorensen and Olivier, 2002; Cancian *et al.*, 2007), and have varied effects on non-mandated forms of involvement (Nepomnyaschy, 2007; Nepomnyaschy and Garfinkel, 2010; Gunter, 2013).[19] The evidence on paternal labor supply is also mixed: Freeman and Waldfogel (1998) find no correlation between child support enforcement and fathers' work behavior, while Holzer *et al.* (2005) and Cancian *et al.* (2013) show a negative relationship between child support mandates and paternal formal labor supply. With regard to family formation, to the best of our knowledge, no previous work has examined subsequent fertility patterns of mothers and fathers who have already separated. However, there is evidence that greater child support enforcement is negatively correlated with overall non-marital fertility rates, possibly implying that a deterrence effect on men may dominate the opposite effect on women (Case, 1998; Huang, 2002; Plotnick *et al.*, 2004; Aizer and McLanahan, 2006).

On the whole, the current literature has not yet painted a complete picture of how child support obligations affect parental behavior. Moreover, existing studies may be limited in their ability to establish causal relationships as child support enforcement spending and the timing of policy implementation may be correlated with other state time-varying factors that could affect the outcomes of interest (e.g., local labor market conditions, other welfare programs, changes to population demographics, etc.). Additionally, by relying on self-reported income in survey data, most of the existing work does not match fathers to their actual child support obligations.

Most recently, two papers have used proprietary data from Wisconsin to study the impacts of child support on parental employment and cohabitation decisions. In the first paper, Cancian *et al.* (2013) exploit the fact that birthing costs are charged to unmarried fathers as child support when their children's births are covered by Medicaid. Using variation in birthing costs across 23 counties, they show that higher child support debt is associated with lower subsequent earnings among low-income fathers. In the second paper, Cancian and Meyer (2014) study a randomized experiment conducted on approximately 700 single mothers in Wisconsin's Temporary Assistance

[19] In particular, Nepomnyaschy (2007) finds fathers who pay more child support increase contact with their children (i.e., formal payments and contact are complements); Nepomnyaschy and Garfinkel (2010) find evidence of substitution between formal and voluntary payments; Gunter (2013) shows that formal payments and in-kind transfers may be substitutes as well.

for Needy Families (TANF) program, and find that mothers who received higher child support payments were less likely to cohabit with new partners.

Our work builds on this literature by applying a new identification strategy and using administrative population-level data to lend causal estimates of the effects of child support obligations on a comprehensive set of parental behavioral outcomes.

4 Data

We use administrative register data on all children born in Denmark over 1985-2008, their siblings and their parents. For each parent and for each year the parent resides in Denmark, we observe his/her income from different sources, cohabitation and marital status, labor market behavior (employment, labor force status, and annual wages), and educational attainment, as well as demographics such as exact date of birth and country of origin. Administrative data has clear advantages over survey data—we can rely on accurately measured information on key variables such as income and family structure, and observe outcomes for a large sample of separated parents. At the same time, administrative data has its drawbacks. For example, we do not observe whether parents have formal or informal child support agreements, fathers' visits with their non-custodial children, or fathers' in-kind transfers and non-monetary gifts to their children. We discuss these issues further in Section 5, and attempt to shed some light on these variables using supplemental survey data.

Analysis Sample To construct our analysis sample, we begin with a sample of all fathers who are observed in the register data in every year over 1998-2010 and who either (i) were married to or cohabiting with their oldest children's mothers at the time of childbirth (or in 1998 for oldest children born before), or (ii) had a first child between 1999 and 2008 while not married to or cohabiting with the child's mother. For each father, the year in which he either is no longer observed to reside with his oldest child's mother or has a first child while not married to or living with the child's mother is referred to as the "separation year". As child support guidelines prior to 1999 did not exhibit as much variation with respect to income and were often not enforced, we limit to the $124,114$ fathers with separation years between 1999 and 2008. We choose 2008 as the final separation year to allow for at least three years of post-separation observations in the data.

Finally, we limit the sample to fathers who had either one or two children aged less than 18 at the time of separation and who had annual separation year incomes in a $100,000$DKK window surrounding the range of the first three thresholds in the child support schedule, where much of the

variation occurs (between 175,000DKK/$31,979 and 505,000DKK/$92,957).[20] These restrictions create a panel of 73,325 fathers linked to their children and their children's mothers. Our analysis uses one observation per father.[21]

Outcomes We consider four sets of outcomes in our analysis. First, we study fathers' child support payments. Information on payments comes from the register data, which records annual monetary transfers made by non-custodial fathers to their children that are tax-deductible and reported to the tax authorities. In other words, we observe all payments made above the non-tax-deductible extra amount. Unfortunately, as noted above, our data does not have information on whether the payments are made under formal agreements or whether they are made voluntarily.

Second, we study father-child co-residence as a measure of paternal physical custody. This measure is imperfect because we can only observe one residence address per individual per year in our data. Thus, we can observe some fathers sharing in physical custody based on whether they are registered at the same residence as their children in any year post-separation, and this measure captures both joint and sole-father physical custody arrangements. However, this measure does not capture joint custody arrangements in which the child is registered at the mother's home, and we therefore underestimate the prevalence of joint physical custody.

Third, we study both parents' post-separation fertility. Since we have the universe of birth records through 2010, we are able to capture this outcome very accurately in our data. Fourth, we examine both parents' labor market behavior, using information on their labor force participation, earnings, and take-up of programs such as disability insurance and early retirement.

5 Empirical Methods

We are interested in the effects of fathers' child support obligations on parental behaviors after separation. Consider a model of the form:

$$Y_i = \pi_0 + \pi_1 Oblig_i + \kappa' X_i + u_i \tag{1}$$

[20] We drop fathers with more than two children at the time of separation because they constitute a relatively small fraction of the sample (10%) and experience much of the child support formula variation at higher income levels where the data contain fewer observations.

[21] The 73,325 observations represent unique fathers who are linked to their oldest children's mothers. However, mothers can appear multiple times in these data as they can have multiple first births with different partners from whom they separate. As such, when we analyze mothers' outcomes, we only consider their first separation spells and are left with 72,097 unique mother observations.

for each father i. Y_i is an outcome of interest measured *post-separation*, such as the father's average annual child support payment or an indicator for the father having subsequent children. $Oblig_i$ is a measure of the father's child support obligation during the time of separation observed in the data, X_i is a vector of observable parental characteristics (such as education and income), and u_i is the error term.

The primary concern with estimating equation (1) using ordinary least squares is that unobserved omitted variables (i.e., those contained in u_i) are correlated both with the father's child support obligation and with parental outcomes. For example, in the U.S., child support obligations are often assigned by judges in courts. Although a judge is generally required to follow his state's child support guidelines, he may also take into account information about the parents that is unobservable to the researcher (e.g., how much conflict the parents have, how close the father is to the child, etc.) when setting the father's obligation. These characteristics of the family may in turn be correlated with parental behavior post-separation—for instance, a judge may assign a higher child support obligation to a father who seems closer to his non-custodial child, and this father may be less likely to start a new family after separation.

Using Variation from the Danish Child Support Guidelines The Danish context presents a unique opportunity to address these endogeneity concerns. As we described in detail in Section 2, in Denmark, child support obligations are determined entirely according to a formula set by a central government agency, and not through the court system. A father's obligation is a non-linear function of his income and number of children, and this function changes in every year during our analysis time frame.

Since income thresholds in the child support formula induce discontinuities in obligations, a regression discontinuity (RD) design may seem like the natural estimation strategy. However, there are several issues with implementing an RD in this setting. First, the thresholds are quite close together in the income distribution (for example, in some cases, the thresholds are just $5,000$DKK ($840) apart), meaning that there are not enough observations immediately surrounding each threshold to implement an RD in practice. Second, the locations of the thresholds change every year. Thus, a father's income might place him on one side of a threshold in one year and on the other side in another year (even if he does not change his income). Since we are interested in the effects of child support obligations averaged over multiple years post-separation, the annually changing thresholds make it difficult to create a uniform RD treatment variable (in other words, is a father who is just above a threshold in year 1 and just below a threshold in year 2 in the "above"

or "below" group?). Third, the fact that there are multiple thresholds in each year and for each number of children makes it challenging to center the observations around any particular threshold.

Thus, instead of estimating an RD, we exploit the full scope of variation in child support guidelines by essentially comparing fathers who have different incomes, different numbers of children, and different separation years, while controlling flexibly for the main effects and double interactions of income, number of children, and year. To implement this empirical design, we first use the child support guidelines to calculate each father's annual child support obligation based on his income and number of children aged less than 18 in each year post-separation observed in our data. For example, for fathers who separate in 2005, we calculate child support obligations for each year over 2005-2010. We then calculate the average annual obligation for each father over the time of separation.

Importantly, we calculate child support obligations for *all* divorced and separated fathers in our sample. As we explained in Section 4, we do not have information on formal agreements and we measure joint physical custody imperfectly. Consequently, we cannot limit our analysis only to parents who should be subject to the formal child support guidelines (i.e., those who have a formal agreement and who do not share physical custody). However, even if we had the information to make this sample selection, we believe that doing so would be problematic. Child support obligations may impact decisions about formal agreements and custody arrangements, meaning that selecting the sample on these potentially endogenous variables would create biased estimates in our analyses.

Consider now the following specification:

$$Y_i = \theta_0 + \theta_1 AvgOblig_{itk} + \lambda' X_{it} + \sigma_t + f(income_i) + \rho_k$$

$$\sigma_t \times f(income_i) + \rho_k \times f(income_i) + \sigma_t \times \rho_k + \varepsilon_{itk} \tag{2}$$

for each father i who separated from his oldest child's mother in year t, and with k number of children aged less than 18. As before, Y_i is an outcome of interest measured *post-separation*. $AvgOblig_{itk}$ is the father's average annual child support obligation in thousands of real year 2000 DKK during the time of separation based on our calculations using the child support guidelines as described above.[22]

[22]We use the average annual child support obligation as the main explanatory variable because we can relate it easily to average annual payments (one of our outcomes of interest). We prefer to use average annual payments to capture paternal monetary transfers during separation to reduce some of the measurement error that arises when, for example, fathers skip payments in one year and make extra (back-)payments in a subsequent year. However, our results are similar (although at times less precise) when we instead use the child support obligation measured in the

The vector X_{it} includes controls for a variety of family characteristics measured *in the year of separation*: father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher education, college/university, and missing), an indicator for the father being born in western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher education, college/university, and missing), an indicator for the mother being born in western Europe, mother's total income in year 2000 DKK, oldest child's age and age squared, youngest child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). σ_t are fixed effects for the year of separation, ρ_k are fixed effects for the father's number of children under age 18, and $f(income_i)$ is a flexible function of the father's real gross income in each year post-separation.

Since equation (2) controls flexibly for the three determinants of child support obligations—father's income, number of children, and the year of separation—the effects of child support obligations should be identified off the non-linearities in and changes to the child support guidelines that generate differences in obligations for fathers who (i) have the same income and year of separation, (ii) have the same income and number of children, or (iii) have the same number of children and year of separation. Yet an important concern remains. The key treatment variable, $AvgOblig_{itk}$, is calculated using the father's income and number of children in each year after separation. However, post-separation changes to the father's income and number of children may occur in response to the child support obligations and are thus potentially endogenous.

Simulated IV Method To deal with this issue, we follow the simulated IV approach (used most recently by Dahl and Lochner (2012), among others). For each father, we calculate a predicted obligation in each year post-separation using his gross income and number of children *at the time of separation*. These predicted obligations account for the father's children aging out of child support by turning 18, but do not take into account any new children that he has with subsequent partners or any changes in the father's income post-separation. As such, the variation in predicted obligations comes only from variation in what the father would have to pay based on changes in the guidelines, *holding constant any possible behavioral responses*. We calculate the average predicted obligation over the time of separation, and use this predicted measure to instrument for the actual average obligation. The first stage regression takes the form of:

$$AvgOblig_{itk} = \eta_0 + \eta_1 PredOblig_{itk} + \zeta' X_{it} + \delta_t + f(income_{it}) + \alpha_{kt}$$

year of separation or in the year after separation as the key explanatory variables.

$$+\sum_{j=1}^{T}\alpha_{k,t+j}+\delta_t\times f(income_{it})+\alpha_{kt}\times f(income_{it})+\delta_t\times\alpha_{kt}+e_{itk} \tag{3}$$

where $PredOblig_{itk}$ is the average predicted obligation, calculated using the father's separation year income and number of children. The IV model is:

$$Y_i=\beta_0+\beta_1\widehat{AvgOblig}_{itk}+\gamma' X_{it}+\delta_t+f(income_{it})+\alpha_{kt}$$

$$+\sum_{j=1}^{T}\alpha_{k,t+j}+\delta_t\times f(income_{it})+\alpha_{kt}\times f(income_{it})+\delta_t\times\alpha_{kt}+\epsilon_{itk} \tag{4}$$

We include fixed effects for the year of separation, δ_t, and fixed effects for the number of children in the year of separation, α_{kt}. We also include a set of indicators for the father's number of children still under age 18 in each year post-separation (but not including any new children born after separation), denoted by $\sum_{j=1}^{T}\alpha_{k,t+j}$ (where T is the total number of years post-separation observed in the data). The model includes a flexible function of the father's real gross income in the year of separation $f(income_{it})$, and all of the double interactions between income, number of children, and the year of separation. The key coefficient of interest is β_1, which measures the effect of a $1,000$DKK increase in the average annual child support obligation on the outcome of interest.

Additionally, while our baseline estimates represent the effects of average annual obligations over all the years of separation, we also investigate the timing of their impacts more closely. For these analyses, we estimate the following IV models:

$$Y_{i,t+\tau+1}=\beta_0+\beta_1\widehat{AvgOblig}^{\tau}_{itk}+\gamma' X_{it}+\delta_t+f(income_{it})+\alpha_{kt}$$

$$+\sum_{j=1}^{\tau}\alpha_{k,t+j}+\delta_t\times f(income_{it})+\alpha_{kt}\times f(income_{it})+\delta_t\times\alpha_{kt}+\epsilon_{ik,t+\tau+1} \tag{5}$$

where τ ranges between 1 and 5. Thus, for years $\tau\in[1,5]$—the first five years of separation—we study the relationship between outcomes measured in year $t+\tau+1$ and $\widehat{AvgOblig}^{\tau}_{itk}$, which denotes obligations averaged over the preceding post-separation years only (i.e., years t to $t+\tau$).

Identifying Assumption The identifying assumption for the estimation of equations (3), (4), and (5) is that—conditional on the father's separation year income, number of children, and the year of separation—there are no omitted variables that systematically covary with both predicted child support obligations and parental post-separation behaviors. The separation year fixed effects control for any overall trends in parental outcomes over the time of our analysis, and absorb any

effects of national policies that may have been implemented in any given year.[23] Moreover, by including fixed effects for the number of children and interacting them with separation year fixed effects, we control for the fact that one- and two-child families may be different and may have different trends over time. Finally, we allow for a flexible relationship between the father's annual separation year income and the outcomes of interest (e.g., we include different order polynomials as well as non-parametric specifications controlling for small income bins), and allow for this relationship to be different over time and across families with different numbers of children by including interactions between $f(income_{it})$ and the fixed effects for separation year and number of children.

There are several remaining possible threats to identification. First, recall that our sample is limited to parents who have divorced or separated. However, if divorce and separation decisions are made in response to (anticipated) child support obligations, then our analysis could be subject to sample selection bias as obligations may affect the composition of parents who appear in our sample. We examine the relationship between child support obligations and the likelihood of parental separation in Table 1. For these regressions, our sample is a panel of all fathers in our data observed over 1999-2010 (i.e., we do *not* limit to those who have separated as we do for our main analysis).[24] We only keep father-year observations until the year of separation (if it occurs). Our outcome of interest is an indicator for parents separating, divorcing, or having an out-of-wedlock/cohabitation birth. We regress this outcome on the child support obligation that a father would face in that year (calculated based on his income and number of children), with a full set of fixed effects and interactions for the number of children, year, and different functions of the father's income.[25] The results show that child support obligations are not systematically correlated with the likelihood of parental separation. While there are some significant effects in specifications using lower-order polynomial functions in father's income, they have opposite signs. Moreover, in our preferred specification that includes indicators for $20,000$DKK (approximately $\$3,630$) bins of father's income, we find no statistically significant relationship. We thus conclude that, in our data, parents do not seem to make their divorce and separation decisions in anticipation of expected child

[23] Additionally, the year of separation fixed effects control for differences in the length of separation time, T, observed in our data.

[24] We do, however, make the same sample restrictions on income, number of children, and years of observation as before: We limit to fathers who were either married to or cohabiting with their oldest children's mothers at the time of childbirth (or in 1998 for oldest children born before), or who had a first child between 1999 and 2010 while not cohabiting with their child's mother. We also only keep father-year observations with nominal incomes between $175,000$ and $505,000$DKK and with either one or two children aged less than 18.

[25] In column 5, when we include indicators for $20,000$DKK (approximately \$3,630) bins in the father's income, for computational feasibility, we collapse the data into cells according to the interactions these father income bins, years 1999-2010, and the number of children. The regression in column 5 is weighted by the number of observations in each cell and has standard errors clustered on the cell level.

support obligations.

Second, while we inherently cannot test whether the variation in predicted child support obligations is correlated with omitted unobservable factors, we can at least check whether it is related to any observable parental characteristics that are not used in the child support formula. For these regressions, we focus on our main analysis sample of divorced and separated parents, and estimate reduced-form versions of equation (4), omitting the controls in vector X_{it} and with the following variables measured in the year of separation as outcomes: father's age, mother's age, indicators for the father's and mother's education levels (university, vocational/short-term higher education, high school only), and mother's income. The results, presented in Table 2, show that predicted obligations have no statistically significant relationships with any of these variables.

A third concern for our identification strategy is that fathers may respond to future child support obligations by changing their incomes *before* separation. Such anticipatory behavior would make our instrument—which is based on the father's separation year income—potentially endogenous. Since the child support formula is a fairly complex non-linear function of the father's income that is changed in every year, most fathers are unlikely to be able to predict their future post-separation obligations very accurately. Nevertheless, we evaluate the plausibility of this issue in two ways in Section 6: (i) we show that our results are similar when we predict child support obligations using the father's income in the year before separation (instead of the year of separation), and (ii) we provide evidence that fathers' labor supply behavior in the years before separation is uncorrelated with future obligations.

Summary Statistics Appendix Table 2 provides summary statistics on selected variables. Column 1 reports information on all fathers in our sample, while columns 2-4 split the sample by parental relationship status—previously married, previously cohabiting, and never-married/non-cohabiting, respectively. The average separation year real gross incomes for fathers and mothers in our sample are 286,300DKK and 205,600DKK, respectively, which are slightly larger than the corresponding average real incomes of 262,000DKK and 191,300DKK for all Danish men and women over the same time period.[26] Additionally, previously married parents are older, wealthier, and more educated than previously cohabiting parents, who in turn are more advantaged than never-married/non-cohabiting parents.

Appendix Table 2 also presents information on the average annual child support obligations that we calculate and the payments we observe. We report the predicted and actual annual tax-

[26]Information on average incomes for Danish men and women comes from Statistics Denmark.

deductible obligations (i.e., obligations net of the extra amount) so that we can more accurately compare them to the tax-deductible payments we see in our data. For all fathers in our sample over the time of separation, the average annual obligation net of the extra amount is 17,500DKK, while the average annual payment net of the extra amount is 9,211DKK.

Differences Between Obligations and Payments We investigate the discrepancy between obligations and payments further in Appendix Table 3. Here, we show that, on average, fathers pay about 53 percent of their tax-deductible obligation. This gap is partially driven by the 19 percent of sample fathers who make zero child support payments post-separation. These "non-payers" are likely comprised of two groups: (i) fathers without formal child support agreements (including those who have full or joint physical custody of their children), and (ii) fathers who are completely non-compliant with their obligations.[27]

While we inherently cannot distinguish between these two groups in our data, we provide some indirect evidence suggesting that joint and sole-father physical custody arrangements likely play a large role in explaining the zeros. As described in more detail in Appendix C, we link our administrative data to survey data with parent-reported information on custody arrangements. Since the surveys were only conducted in selected years and have small sample sizes, we do not use these data for our main analysis and instead just examine them descriptively. We show that survey reports of joint and sole-father physical cusody arrangements coincide with lower average post-separation child support payments and with a higher prevalence of zero payments by fathers. Additionally, in our administrative data, among the 6 percent of fathers who are registered at the same residence as their oldest children in all years after separation (which is an underestimate of the joint physical custody rate), nearly two-thirds make zero child support payments.[28]

While the "non-payers" account for some of the gap between average obligations and payments, they do not explain all of it. Among those who pay a strictly positive amount, fathers on average pay 66 percent of their tax-deductible obligation. We find that 72 percent of the fathers in the sample pay more than zero but less than their obligation, while 9 percent pay the amount of the obligation or more. The "underpayment" likely results the fact that we observe both mandated and voluntary payments in one variable where voluntary payments do not need to follow any guidelines,

[27] A third possibility in our data is that some fathers make child support payments but do not report them to the tax authorities. However, given that all payments above the extra amount are tax deductible, this seems unlikely as fathers have a strong incentive to report these transfers.

[28] Moreover, other data suggest that out of all Danish children aged 11-15 who had split parents in 2005-2006, about 20 percent lived in either joint or sole-father physical custody arrangements—a number very close to the percentage of "non-payers" that we observe in our sample (Bjarnason and Arnarsson, 2011).

as well as possibly from imperfect compliance. "Overpayment" is most common among previously married parents and is likely driven by voluntary payments.

Finally, it may be that some of the fathers whom we observe "under-paying" give supplemental gifts or in-kind transfers to their children that are not recorded in our administrative data. The survey has some information on these types of non-pecuniary transfers. For example, about 18 percent of mothers report that the father has bought some winter clothes for his child, while around 4 percent report that the father has paid for childcare.[29] These numbers suggest that large in-kind transfers are not pervasive in our analysis population.

6 Results

6.1 First Stage Results

We begin by presenting results from a first stage regression of actual average child support obligations on average predicted obligations. Table 3 presents the results from estimating equation (3), controlling for different functions of the father's real separation year income: linear (column 1), quadratic (column 2), cubic (column 3), quartic (column 4), and indicators for 20,000DKK bins (column 5). Across all of the specifications, the first stage is very strong (the F-statistic ranges between 1,972 and 5,190). Our preferred specification in column 5 indicates that each 1,000DKK increase in the average predicted obligation is associated with a 840DKK increase in the actual average obligation.

6.2 Child Support Payments and Father-Child Co-Residence

We next study how child support obligations affect fathers' child support payments and father-child co-residence. Table 4 presents results from estimating equation (4) using two-stage least-squares (2SLS) for the following outcomes measured post-separation: father's average annual child support payment, an indicator for the father's average child support payment being greater than his average obligation, an indicator for the father paying zero child support in at least one year, and an indicator for the father living with his oldest child in at least one year.[30] In these specifications, the $f(income_{it})$ function is captured by indicators for 20,000DKK bins in the father's real separation year income.

[29]These figures come from the 1999 wave of the Danish longitudinal survey of children (DALSC) where children of interviewed mothers were three years old. See Appendix C for details.

[30]The regression results using average obligations net of the extra amount are identical to those reported here as the extra amount does not vary across the father's income and so all variation in the extra amount is entirely absorbed by the interactions between the year of separation and the number of children.

Column 1 shows that a 1,000DKK increase in the average annual child support obligation is associated with a 507DKK increase in the average annual payment. In Section 3, we hypothesized that the lack of a one-for-one correlation may be in part driven by supplemental voluntary payments. Indeed, in column 2, we show that a higher obligation reduces the likelihood that a father pays more than what he is obligated to pay, suggesting that mandated payments may be partially substituting for voluntary payments that fathers would have otherwise made. Additionally, the less than perfect correlation between obligations and payments may be due to the other parental behavioral responses, which we analyze below.

In column 3, we see that fathers facing higher obligations are less likely to pay zero in at least one post-separation year. Column 4 shows that this effect seems to be driven by a reduction in paternal physical custody: a 1,000DKK increase in the average obligation is associated with a 2.1 percent decrease in father-child co-residence post-separation.

As discussed in Section 3, there are two opposing forces on paternal physical custody. On the one hand, relative to fathers with lower child support obligations, fathers facing larger obligations may have a greater incentive to avoid paying them by instead sharing in physical custody. On the other hand, mothers have the opposite incentive to receive the higher payments by making sure that fathers do not share in physical custody. Additionally, fathers with higher obligations may be more likely to substitute away from other forms of non-pecuniary involvement with their children. Our empirical results suggest that the latter forces seem to dominate in our sample, leading to a negative relationship between obligations and paternal physical custody rates.

In Appendix Figure 3, we investigate the timing of the paternal physical custody effect during the length of separation. This figure presents the coefficients and 95% confidence intervals from five separate IV regressions of equation (5). For years $x \in [1, 5]$—the first five years of separation displayed on the x-axis—each regression uses an indicator for the father living with his oldest child in year $x + 1$ post-separation as the dependent variable and the average annual obligation over the preceding post-separation years (0 to x) as the explanatory variable. The results suggest that the magnitude of the reduction in the paternal physical custody rate is increasing over the length of separation, although the confidence intervals are large enough such that we cannot reject that all five coefficients are equal.

We test the robustness of these results across different specifications in Appendix Tables 4 to 9. As outcomes, we look at average child support paid and an indicator for the father living with his child in at least one year post-separation. Appendix Tables 4 and 5 consider four alternative polynomial functions of the father's separation year income: linear (column 1), quadratic (column

2), cubic (column 3), and quartic (column 4); the main specification from Table 4 is replicated in column 5 for ease of comparison. Appendix Tables 6 and 7 consider four alternative "bin" indicator functions of the father's separation year income: 50,000DKK bins (column 1), 25,000DKK bins (column 2), 20,000DKK bins (column 3; same as the main specification), 15,000DKK bins (column 4), and 10,000DKK bins (column 5). Appendix Tables 8 and 9 consider four alternative samples based on father's income windows surrounding the first three thresholds in the child support formula: 20,000DKK (column 1), 40,000DKK (column 2), 60,000DKK (column 3), 80,000DKK (column 4), and 100,000DKK (column 5; same as the main sample of analysis). For both outcomes, across the additional 24 regressions, the coefficients are of the same sign and of similar magnitude as those reported in Table 4. Moreover, 20 out of the 24 coefficients are statistically significant at the 5 percent level. These robustness tests provide support for the validity of the identification strategy and the strength of the results.

In sum, these results suggest that, while government-mandated child support obligations are moderately effective in increasing fathers' monetary payments to children, they may also crowd-out other forms of father involvement, such as voluntary payments and father-child co-residence.

6.3 Parental Subsequent Family Formation

Next, we proceed to examine parental fertility post-separation. Tables 5 and 6 present the 2SLS results for family formation outcomes for the mothers and fathers, respectively.

We find that, for both parents, higher child support obligations lead to increased subsequent fertility with new partners. In particular, the first columns in both tables show that each 1,000DKK increase in the child support obligation is associated with 3.2 and 3.7 percent increases in the likelihoods of mothers and fathers having more children, respectively. Notably, as seen in columns 2 to 4, fathers increase their fertility only within marriage or cohabitation, while mothers increase their fertility both in and outside these unions. Appendix Tables 10 and 11 test the sensitivity of these results to different polynomial functions of the father's separation year income and show that the estimated coefficients are quite stable across specifications.

We also explore the timing of the fertility effects for mothers and fathers in Appendix Figures 4 and 5, respectively. For fathers, fertility increases materialize after 4 to 5 years post-separation, while for mothers, the positive impacts on fertility are present 3 and 5 years after separation.

As we discussed in Section 3, the positive impact on maternal fertility is consistent with higher child support obligations generating greater income effects. The magnitude of our estimate—a 3.2 percent increase for every 1,000DKK increase in obligations—is comparable to estimates in the

existing literature on the income-fertility relationship. For example, after converting the estimates from Canadian dollars to Danish krones, Milligan (2005) finds a 3.4 percent increase in fertility associated with a 1,000DKK increase in tax benefits in Quebec. In France, the relevant relationship is a 4 percent increase in fertility for every 1,000DKK increase in benefits (Laroque and Salanié, 2008). In the UK, there is a slightly more modest 2 percent increase in fertility for every 1,000DKK increase in welfare benefits stemming from a 1999 reform (Brewer *et al.*, 2012).[31]

For fathers, the positive relationship between obligations and fertility is consistent with two incentives. First, we found above that higher obligations are associated with a reduced incidence of father-child co-residence. Thus, fathers who are facing higher obligations may have less attachment to their existing children and more demand for new offspring with new partners. Second, fathers with incomes in certain ranges above the child support step function thresholds can reduce their obligations to non-custodial children by having more children within new unions. Column 5 of Table 6 shows that the fertility increase is driven by fathers who do not reside with their older children post-separation, consistent with the first incentive.[32]

Finally, the fact that fathers facing larger obligations only increase fertility within marriage or cohabitation is consistent with them expecting higher costs of future children born outside these unions. By contrast, mothers receiving higher child support payments for current children may expect higher transfers for future children if they separate again. Thus, higher obligations are associated with increased maternal fertility both in and outside new partnerships.

6.4 Parental Labor Market Behavior

Finally, we analyze the effects of child support obligations on parental labor market outcomes. Table 7 presents the 2SLS results on fathers' post-separation labor market behavior. We find that, on average, higher obligations are associated with a reduction in the amount of time fathers spend in the labor force. Specifically, each 1,000DKK in the child support obligation reduces the fraction of years post-separation during which they have any positive labor income by 0.2 percent and

[31] More precisely, Milligan (2005) finds that a $1,000 (in Canadian dollars) increase in tax benefits increases fertility by 17%. $1,000 Canadian dollars is approximately 5,000DKK. Laroque and Salanié (2008) find that 100 Euros per month (i.e., 1,200 Euros per year) increase higher-parity fertility by 37%. 1,200 Euros is approximately 8,957DKK. Brewer *et al.* (2012) find that the mean £900 increase in welfare benefits following a 1999 reform led to a 15% increase in fertility among low-income married women. £900 is approximately 8,300DKK. The muted response in the U.K. may be in part due to an accompanying work incentive that likely reduced fertility.

[32] In supplementary analyses, we explored the heterogeneity in the paternal fertility response with regard to the father's separation year income. While we found no statistically significant differences across fathers with incomes above and below the first guideline threshold, the signs and magnitudes of the coefficients are consistent with fathers who have separation year incomes above the threshold having a greater incentive to have subsequent children within new unions.

increases the proportion of years they spend not in the labor force ("NILF") by 5 percent at the respective sample means. In contrast, we find no consistent evidence of changes to maternal labor market behavior (see Appendix Table 12).

Appendix Table 13 shows that the result on paternal labor force participation is robust across different polynomial functions of the father's separation year income. Further, by studying labor market outcomes that are measured both before and after separation, we can test for anticipatory effects on paternal labor force participation pre-separation. Specifically, in Figure 3, in addition to looking at the timing of effects post-separation, we also study whether obligations in the year of separation are correlated with paternal labor force participation in the five years *before* separation. We find that the coefficients in the years before separation are all very close to zero, and that the positive effect on the likelihood of the father being out of the labor force begins to materialize about 3 years following separation.

We explore the overall negative effect on paternal labor force participation further in columns 6 to 8 of Table 7, and find that it seems to be driven by transitions into disability leaves and retirements (including discretionary early retirements).[33] In contrast, we find no effects on exiting the labor force to receive welfare benefits, as this transition is likely unrealistic for the majority of our (relatively higher-income) sample fathers due to the associated strict means-testing.

Moreover, although these results point to higher obligations being associated with lower paternal labor supply on average, they conceal important heterogeneity in responses. As we hypothesize in Section 3, the structure of the child support guidelines creates divergent labor supply incentives depending on where the father's income is located relative to the step function thresholds. To test for such differential responses, we include an interaction term with an indicator for the father's separation year income being above the first threshold in that year in Table 8. We find that fathers with separation year incomes below the first threshold actually increase their labor supply. The decline in labor force participation is driven entirely by fathers with separation year incomes above the first threshold, who have an incentive to reduce their labor supply in order to avoid paying the additional percentages of the normal amount.

[33]In Denmark, individuals mainly receive disability income through the Social Disability Pension (SDP) program. SDP is granted based on several medical and social criteria, and there are three levels depending on the degree of work capacity. Eligibility for the lowest level depends on work capacity having been reduced to below half the normal level, based on an evaluation using a combination of health and social criteria. Thus, although transitioning from the labor force and into disability leave is not costless, the subjectivity in the eligibility requirements leaves room for behavioral responses on this margin that may be unrelated to changes in fathers' actual health conditions. The main retirement program in Denmark is the Old Age Pension program, for which individuals are eligible starting at age 65. The Post-Employment Wage (PEW) program is the program for early retirement, for which individuals are eligible during ages 60-64. Other eligibility requirements for the PEW include sufficient contributions to the Unemployment Insurance fund and being in the labor force at age 59. See Larsen and Pedersen (2012) for more information.

Overall, as postulated in Section 3, the decline in paternal labor force participation implies that, at least for some fathers, child support obligations play the role of income taxes, with the substitution effect dominating the income effect. Our findings are broadly consistent with other studies on the relationship between the relative value of labor market participation and disability/retirement program take-up in the U.S., Canada, and Europe.[34] Thus, our estimates point to an unintended consequence of child support mandates on public budgets: although they may shift the burden of single-mother household support from welfare programs to non-custodial fathers, they also may pass part of this cost on to other government programs including disability insurance and early retirement.

6.5 Additional Results

Predicting Child Support Obligations Based on the Father's Income in the Year *Before* Separation One important concern with predicting obligations using the father's income in the year of separation is that fathers may respond to their obligations by changing their income immediately (i.e., in the year of separation), thus making our instrument potentially endogenous. This concern is mitigated by the fact that we do not see any statistically significant correlations between the predicted obligations and a variety of parental characteristics measured in the year of separation, and by the fact that labor supply responses do not materialize until 3-4 years post-separation, as discussed above. Nevertheless, in Appendix Table 14, we also present IV results for our main outcomes where we instead predict child support obligations based on the father's income measured in the year *before* separation. These results are similar to the main ones described above, suggesting that endogenous income changes in the year of separation are unlikely to generate substantial biases in our analysis.

Simpler "Double-Difference" Models Our main specification is essentially a type of "triple-difference" IV model. We test the sensitivity of this specification by considering one- and two-child families separately in analyses that only exploit variation in child support guidelines by year of separation and the father's separation year income. These regressions still include the controls in vector X_{it} described above, as well as fixed effects for the year of separation and $20,000$DKK bins in the father's separation year income.[35] Appendix Tables 15 and 16 present the results from these

[34] See, e.g., Black *et al.* (2002); Autor and Duggan (2003); Gruber (2000); Gruber and Wise (2004, 2009); Bratsberg *et al.* (2010); Bingley *et al.* (2011).

[35] We also control for children aging out of child support by turning 18 by including fixed effects for the number of children still under age 18 in each year post-separation (not including any new children born post-separation), as in our main regression equation.

simpler "double-difference" IV specifications. While we lose some power and variation in these analyses, the effects are broadly consistent with the main results reported above. Additionally, these results suggest that the effects of child support obligations on parental outcomes are similar across one- and two-child families.

7 Conclusion

As growing numbers of children in developed countries have parents who are divorced or separated, understanding the causal impacts of government interventions targeting their families is important. Since unmarried and divorced mothers have historically retained physical custody of their children and had full parental rights, most of these government interventions are centered around encouraging father involvement. These policies share the underlying assumption that father involvement is essential to child well-being and seek to reduce public spending by shifting the burden of support of single-mother households from government programs to the children's fathers.

However, the implications of such policies for both child well-being and public budgets depend crucially on their causal impacts on parental behavior. This type of research has thus far been infeasible on a large scale in the United States primarily due to data constraints, and the Danish context provides a unique opportunity to study these issues. We exploit Danish administrative data together with non-linearities in child support guidelines that assign non-custodial parents different obligations according to their incomes, numbers of children, and separation years to study the causal effects of child support mandates on parental outcomes. We estimate that among parents with a formal agreement, a $1,000$DKK increase in a father's average annual child support obligation is associated with about a 507DKK increase in the average annual child support payment.

We also show parental responses on other margins. In particular, higher obligations reduce the likelihood that fathers live with their children in at least one year post-separation, providing some evidence of substitution between monetary and non-pecuniary paternal investments. Additionally, we find that child support obligations increase post-separation fertility for both parents. Both parents are more likely to have additional children while married to or cohabiting with new partners; mothers are also more likely to have children outside these unions. The fertility effect for mothers is consistent with a positive income-fertility relationship, while the fertility effect for fathers is consistent with increased demand for new offspring as a result of reduced contact with existing children. Finally, we find evidence that among higher-income fathers for whom child support obligations represent taxes on earnings, higher obligations are associated with reductions in labor force participation and transitions into disability insurance and early retirement programs.

The findings in this paper point to important parental behavioral responses to redistributive policies meant to address the needs of children growing up in so-called "broken homes". By placing mandates on non-custodial parents to make financial transfers to their children, these policies can disincentivize other forms of non-pecuniary involvement. Moreover, these obligations generate shocks to parental income and time allocation, and can thus impact their subsequent family formation decisions and the division of resources across children. As such, the net impacts on child investment levels and overall child well-being are complicated and ambiguous. Our results cannot directly speak to these implications, although future research might shed light on these issues by exploring the effects of child support mandates on children's cognitive and health outcomes.

The net effects on public spending are also potentially unclear. For example, the fact that some fathers respond to obligations by exiting the labor force and taking up disability insurance or early retirement benefits reveals a possible increase in public sector costs. In 2008, public expenditure on disability pensions amounted to about 16.5 billion DKK ($3.1 billion) in Denmark.[36] Given that there were about $240,000$ recipients in that year, this translates to approximately $69,000$DKK ($\$13,000$) per recipient.[37] Our estimated positive effect on the take-up of disability insurance alone can thus be valued at approximately 20 million DKK ($3.3 million).[38] Of course these increases in public spending costs have to be weighed against any savings, such as those due to possible reductions in maternal take-up of municipal benefits and support programs (e.g., reduced-cost childcare and housing subsidies), which we do not observe in our data. Nevertheless, our findings point to the possible unintended consequences of child support mandates on public budgets.

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[36] See OECD.Stat for more details: http://stats.oecd.org/Index.aspx?DataSetCode=SOCX_AGG.

[37] In 2008, the Danish age 18-64 population was 3,418,273 according to Statistics Denmark, and approximately 7 percent of them were receiving disability income (Bingley *et al.*, 2011). This amounts to $0.07 * 3,418,273 = 239,279$ recipients.

[38] This value is calculated as follows: We estimate a 0.00122 increase in the likelihood of disability insurance take-up, which translates to $0.00122 * 240,000 = 293$ additional recipients. This means that costs are increased by $292 * 69,000$DKK$= 20,148,000$DKK.

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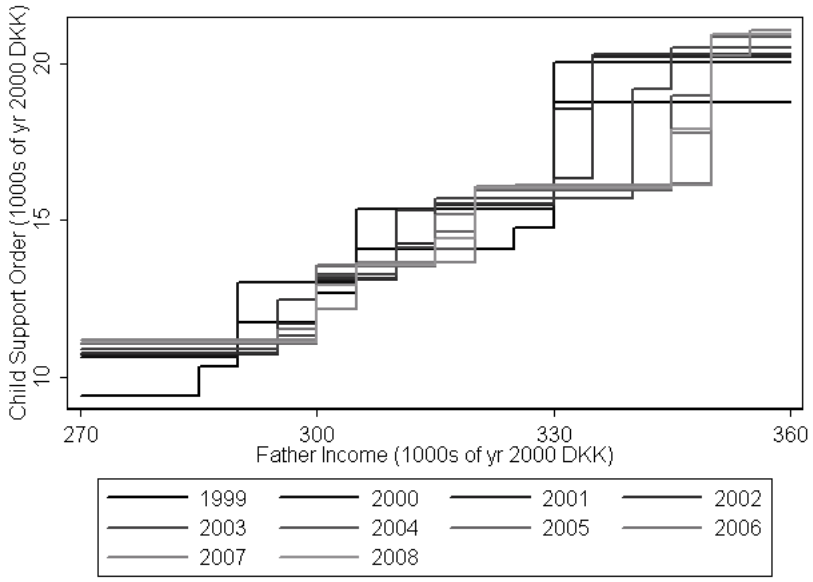
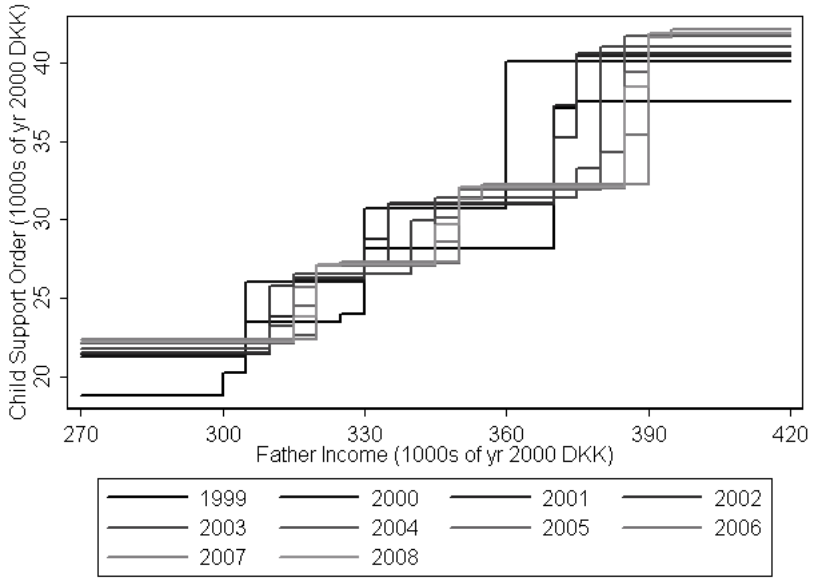
Figure 1: Government-Mandated Child Support Obligations, 1 Child Families, Year 2000 DKK



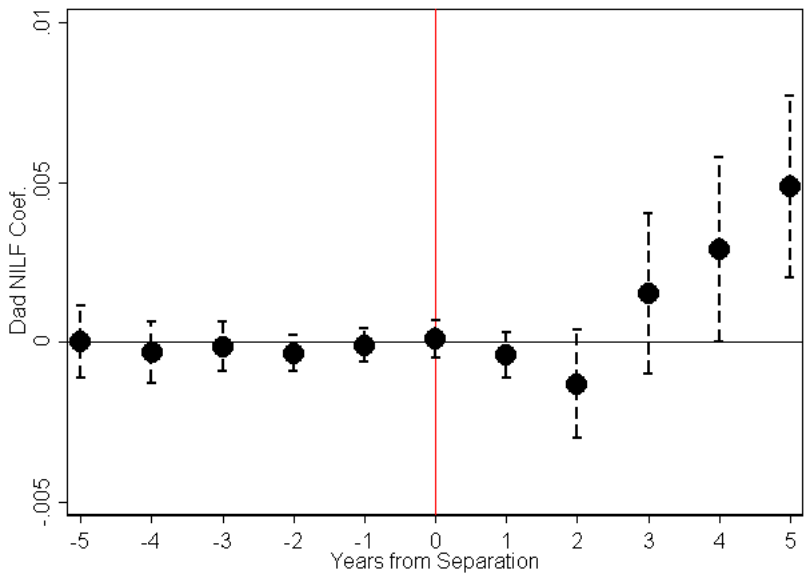
Notes: This figure shows the relationship between a non-custodial father's income and the required amount of child support by year for families with one child. Units are 1000s of real year 2000 DKK.

Figure 2: Government-Mandated Child Support Obligations, 2 Child Families, Year 2000 DKK



Notes: This figure shows the relationship between a non-custodial father's income and the required amount of child support by year for families with two children. Units are 1000s of real year 2000 DKK.

Figure 3: The Effects of Child Support Obligations on Fathers Being Not in the Labor Force (NILF): By Year Before and After Separation



Notes: This figure presents the coefficients and 95% confidence intervals from 11 separate regressions. For years $x \in [1, 5]$, each regression has an indicator for the father being not in the labor force (NILF) in year $x + 1$ post-separation as the dependent variable and the average annual obligation over the preceding post-separation years (0 to x) as the explanatory variable (instrumented by the average predicted obligation which is calculated using separation-year income and separation-year number of children). For years $x \in [-5, 0]$, each regression has an indicator for the father being not in the labor force (NILF) in year x pre-separation as the dependent variable and the obligation in the year of separation as the explanatory variable. See notes under Table 2 for more information on the sample.

Table 1: Effects of Child Support Obligations on the Likelihood of Parental Separation

	Dep. Var.: Parents Separated or Had Out-of-Wedlock/Cohabitation Birth				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Child Support Obligation	0.000214*** [0.0000318]	0.000161*** [0.0000399]	-0.000130** [0.0000523]	-0.0000551 [0.0000628]	-0.000100 [0.000341]
Dad income	-0.0000505*** [0.00000615]	-0.000118*** [0.0000436]	-0.000510** [0.000237]	0.000331 [0.00114]	
Dad inc. squared		0.000000104 [6.41e-08]	0.00000139* [0.000000726]	-0.00000282 [0.00000531]	
Dad inc. cubed			-1.29e-09* [7.19e-10]	7.65e-09 [1.07e-08]	
Dad inc. quartic				-6.88e-12 [7.90e-12]	
Mean, dept. var.	0.0297	0.0297	0.0297	0.0297	0.0206
Obs. (father-years)	2451720	2451720	2451720	2451720	2451720
Number cells					330

Notes: In columns 1-4, units of analysis are father-year observations. In column 5, the units of analysis are cells according to the interactions of 20,000 DKK father income bins, year, and number of children. The regression in column 5 is weighted by the number of father-year observations in each cell. The sample is a panel of fathers of children born in 1985-2010, who appear in the register data in every year over 1998-2010, and who were either married to, cohabiting with, or never-married/non-cohabiting with their oldest child's mother at the time of childbirth for children born in 1998 or later or in 1998 for children born before. Only father-year observations until the year of separation (if it occurs) are kept. The sample is further limited to father-year observations with nominal incomes between 175,000 and 505,000 DKK. (100,000 DKK surrounding the range of the first three cutoffs), and who have either one or two children aged less than 18. In columns 1-4 (column 5), the outcome of interest is an indicator for (fraction of) the parents either separating, divorcing, or have an out-of-wedlock/cohabitation child. All income variables are in year 2000 real units of 1,000 DKK. In columns 1-4, standard errors are robust to heteroskedasticity; in column 5, robust standard errors are clustered on the cell level.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 2: Correlation between Average Predicted Obligation and Parental Characteristics

	(1) F.Age	(2) M.Age	(3) F.Ed:Uni	(4) F.Ed:Voc	(5) F.Ed:HS	(6) M.Ed:Uni	(7) M.Ed:Voc	(8) M.Ed:HS	(9) M.Inc.
Average predicted obligation	0.0123 [0.0214]	-0.0130 [0.0190]	0.00204 [0.00149]	-0.00246 [0.00178]	0.0000646 [0.000678]	0.00214 [0.00160]	-0.000157 [0.00178]	0.000350 [0.000678]	0.394 [0.284]
Mean, dept. var.	36.33	34.14	0.133	0.551	0.0345	0.197	0.432	0.0528	205.6
Obs.	73325	73272	73325	73325	73325	73325	73325	73325	70639

Notes: "F." refers to fathers' characteristics, while "M." refers to mothers' characteristics. The sample is limited to fathers of children born in 1985-2010, who appear in the register data in every year over 1998-2010, and who were either married to, cohabiting with, or never-married/non-cohabiting with their oldest child's mother at the time of childbirth for children born in 1998 or later or in 1998 for children born before. For parents who were never-married/non-cohabiting, the year of separation refers to the year of their oldest child's birth. The sample is further limited to fathers who were either never-married/non-cohabiting and had a child between 1998 and 2008 or who separated or divorced from their oldest child's mother between 1999 and 2008, who had nominal incomes between 175,000 and 505,000 DKK in the year of separation (100,000 DKK surrounding the range of the first three cutoffs), and who had either one or two children aged less than 18 at the time of separation. The average predicted obligation is calculated using the father's income in the year of separation, the number of chidren under 18 in each year post-separation (i.e., accounting for children who age out when they turn 18 but not counting any new children born post-separation), and the formula in each year. All regressions include a full set of fixed effects and interactions for number of children, year, and 20,000 DKK bins in the father's separation year income. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 3: First Stage, Average Predicted Obligations and Actual Average Obligations

	Dep. Var.: Average Child Support Obligation				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average predicted obligation	0.575***	0.678***	0.625***	0.734***	0.841***
	[0.00798]	[0.0137]	[0.0141]	[0.0160]	[0.0164]
Dad income	0.0143***	0.0632***	-0.0367	-1.154***	
	[0.00110]	[0.00704]	[0.0383]	[0.184]	
Dad inc. squared		-0.0000806***	0.000217*	0.00564***	
		[0.0000113]	[0.000123]	[0.000894]	
Dad inc. cubed			-0.000000275**	-0.0000116***	
			[0.000000127]	[0.00000187]	
Dad inc. quartic				8.53e-09***	
				[1.42e-09]	
Mean, dept. var.	19.23	19.23	19.23	19.23	19.23
Obs.	70637	70637	70637	70637	70637
F-stat	5189.7	2431.7	1972.2	2100.5	2619.5
R-squared	0.785	0.786	0.789	0.790	0.792

Notes: Predicted and actual obligations as well as all income variables are reported in 1000s of real year 2000 DKK. This table reports results from a first stage regression of actual average obligations (calculated using fathers' current incomes and numbers of children in each year post-separation) on average predicted obligations (calculated using fathers' separation year incomes and numbers of children). See notes under Table 2 for more information on the sample. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. All regressions include controls (measured in the year of separation) for the father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the father being from Western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the mother being from Western Europe, mother's total income in year 2000 DKK, oldest child's age and age squared, youngest child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 4: IV Effects of Average Child Support Obligations on Fathers' Child Support Payments and Father-Child Co-Residence

	(1) Avg CS Paid	(2) Pay More Than Oblig.	(3) Ever Pay Zero	(4) Ever Live w/ Child
Average child support obligation	0.507*** [0.0369]	-0.00310** [0.00154]	-0.0133*** [0.00146]	-0.00594*** [0.00203]
Mean, dept. var.	9.251	0.0919	0.737	0.278
Fst. Stage Coef.	0.841	0.841	0.841	0.841
Fst. Stage F-Stat	2619.5	2619.5	2619.5	2619.5
Obs.	70637	70637	70637	70637

Notes: The outcomes are defined as follows: 1) "Avg CS Paid" refers to the average annual child support paid by the father in the years post-separation; 2) "Pay More Than Oblig" refers to an indicator for the father's average child support payment being grater than his average child support obligation post-separation; 3)"Ever Pay Zero" refers to an indicator for zero child support paid by the father in at least one year post-separation; 4) "Ever Live w/ Child" refers to an indicator for the father living with the child at least one year post-separation. All income variables are in year 2000 real units of 1,000 DKK. See notes under Table 2 for more information on the sample. All regressions include fixed effects for 20,000 DKK bins in the father's separation year income, number of children at separation, year of separation, and their double interactions. All regressions include controls (measured in the year of separation) for the father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the father being from Western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the mother being from Western Europe, mother's total income in year 2000 DKK, oldest child's age and age squared, youngest child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 5: IV Effects of Average Child Support Obligations on Mothers' Post-Separation Fertility Outcomes

	Mother Has More Kids After Sep.			
	(1) Overall	(2) Mar.	(3) Coh.	(4) Not Mar./Coh.
Average child support obligation	0.00600*** [0.000997]	0.00377*** [0.000703]	0.00147** [0.000739]	0.000832** [0.000372]
Mean, dept. var.	0.185	0.0658	0.0921	0.0287
Fst. Stage Coef.	0.843	0.843	0.843	0.843
Fst. Stage F-Stat	2612.0	2612.0	2612.0	2612.0
Obs.	68940	68940	68940	68940

Notes: The outcomes are defined as follows: 1) "Overall" refers to an indicator for the mother having any children post-separation (regardless of relationship status); 2) "Mar." refers to an indicator for the mother having more children post-separation while married to a new partner; 3) "Coh." refers to an indicator for the mother having more children post-separation while cohabiting with a new partner; 4) "Not Mar./Coh." refers to an indicator for the mother having more children post-separation while neither married or cohabiting. All income variables are in year 2000 real units of 1,000 DKK. See notes under Tables 2 and 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 6: IV Effects of Average Child Support Obligations on Fathers' Post-Separation Fertility Outcomes

	Father Has More Kids After Sep.				
	(1) Overall	(2) Mar.	(3) Coh.	(4) Not Mar./Coh.	(5) Not living w/ older child
Average child support obligation	0.00692*** [0.00116]	0.00325*** [0.000874]	0.00331*** [0.000828]	0.000278 [0.000455]	0.00756*** [0.00103]
Mean, dept. var.	0.186	0.0804	0.0830	0.0238	0.148
Fst. Stage Coef.	0.841	0.841	0.841	0.841	0.841
Fst. Stage F-Stat	2619.5	2619.5	2619.5	2619.5	2619.5
Obs.	70637	70637	70637	70637	70637

Notes: The outcomes are defined as follows: 1) "Overall" refers to an indicator for the father having any children post-separation (regardless of relationship status); 2) "Mar." refers to an indicator for the father having more children post-separation while married to a new partner; 3) "Coh." refers to an indicator for the father having more children post-separation while cohabiting with a new partner; 4) "Not Mar./Coh." refers to an indicator for the father having more children post-separation while neither married or cohabiting; 5) "Not living w/ older child" refers to an indicator for the father having more children post-separation while not living with his oldest child. All income variables are in year 2000 real units of 1,000 DKK. See notes under Tables 2 and 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Table 7: IV Effects of Average Child Support Obligations on Fathers' Post-Separation Labor Market Outcomes

	(1) Any Wage	(2) Log Wage	(3) Emp.	(4) Self-Emp.	(5) NILF	(6) Dis.	(7) Welf.	(8) Ret.
Average child support obligation	-0.00166*	-0.00125	-0.000776	-0.000378	0.00209***	0.00122***	-0.000139	0.00121***
	[0.000984]	[0.00462]	[0.00118]	[0.000999]	[0.000547]	[0.000355]	[0.000312]	[0.000305]
Mean, dept. var.	0.915	12.26	0.832	0.0611	0.0418	0.0113	0.0249	0.00364
Fst. Stage Coef.	0.842	0.844	0.841	0.841	0.841	0.841	0.841	0.841
Fst. Stage F-Stat	2625.5	2572.5	2619.5	2619.5	2619.5	2619.5	2619.5	2619.5
Obs.	70624	69183	70637	70637	70637	70637	70637	70637

Notes: The outcomes are defined as follows: 1) "Any Wage" refers to the proportion of years the father has any wage income post-separation, 2) "Log Wage" refers to the log of the father's average annual wage income in the years post-separation, 3) "Emp." refers to the proportion of years the father is employed in the private or public sector (not self-employed) post-separation, 4) "Self-Emp." refers to the proportion of years the father is self-employed post-separation, 5) "NILF" refers to the proportion of years the father is not in the labor force post-separation, 6) "Dis." refers to the proportion of years the father is not in the labor force due to disability leave post-separation, 7) "Welf." refers to the proportion of years the father is not in the labor force and receiving welfare benefits, and 8) "Ret." refers to the proportion of years the father is not in the labor force due to retirement (including early retirement) post-separation. All income variables are in year 2000 real units of 1,000 DKK. See notes under Tables 2 and 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.

Significance levels: * p<0.1 ** p<0.05 *** p<0.01

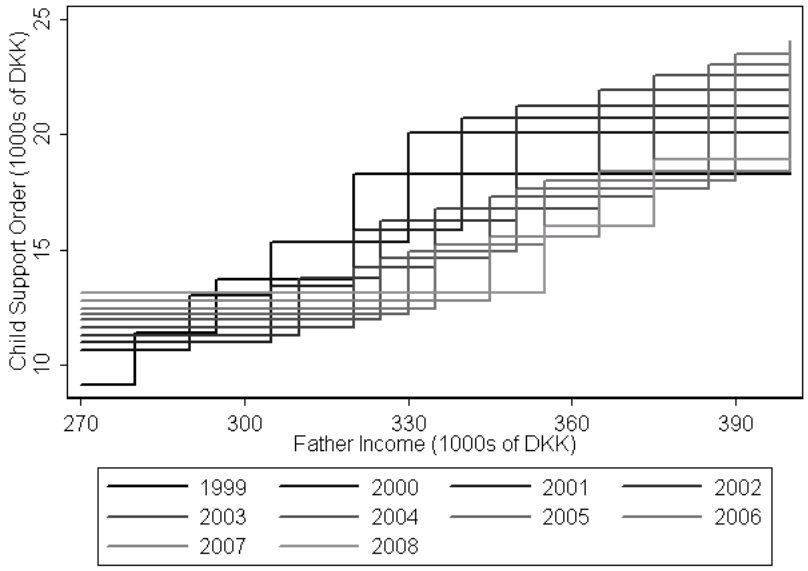
Table 8: IV Effects of Average Child Support Obligations on Fathers' Post-Separation Labor Market Outcomes: Heterogeneity by Income Relative to the First Guideline Threshold

	(1) Any Wage	(2) Log Wage	(3) Emp.	(4) Self-Emp.	(5) NILF	(6) Dis.	(7) Welf.	(8) Ret.
Average child	0.00217*	0.0144**	0.00378**	-0.00203	-0.000836	-0.000585	-0.000161	0.000121
support obligation	[0.00130]	[0.00584]	[0.00159]	[0.00131]	[0.000743]	[0.000482]	[0.000439]	[0.000392]
Average Obligation	-0.00244***	-0.0102***	-0.00290***	0.00104**	0.00186***	0.00115***	0.00000364	0.000698***
* Above Threshold 1	[0.000445]	[0.00198]	[0.000544]	[0.000424]	[0.000288]	[0.000209]	[0.000158]	[0.000135]
Above Threshold 1	0.0456***	0.224***	0.0557***	-0.0162*	-0.0330***	-0.0207***	0.00203	-0.0140***
	[0.00940]	[0.0427]	[0.0116]	[0.00906]	[0.00597]	[0.00429]	[0.00321]	[0.00281]
Mean, dept. var.	0.915	12.26	0.832	0.0611	0.0418	0.0113	0.0249	0.00364
Obs.	70624	69183	70637	70637	70637	70637	70637	70637

Notes: This table presents results from regressions that include an interaction with an indicator for the father's separation year nominal income being above the first threshold in the child support guidelines. The outcomes are defined as follows: 1) "Any Wage" refers to the proportion of years the father has any wage income post-separation, 2) "Log Wage" refers to the log of the father's average annual wage income in the years post-separation, 3) "Emp." refers to the proportion of years the father is employed in the private or public sector (not self-employed) post-separation, 4) "Self-Emp." refers to the proportion of years the father is self-employed post-separation, 5) "NILF" refers to the proportion of years the father is not in the labor force post-separation, 6) "Dis." refers to the proportion of years the father is not in the labor force due to disability leave post-separation, 7) "Welf." refers to the proportion of years the father is not in the labor force and receiving welfare benefits, and 8) "Ret." refers to the proportion of years the father is not in the labor force due to retirement (including early retirement) post-separation. All income variables are in year 2000 real units of 1,000 DKK. See notes under Tables 2 and 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

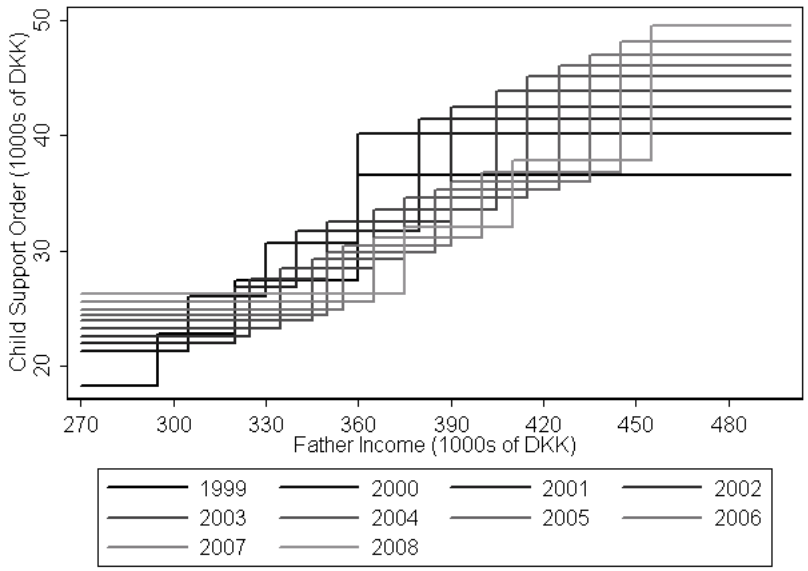
A Appendix Figures and Tables

Appendix Figure 1: Government-Mandated Child Support Obligations, 1 Child Families, Nominal DKK



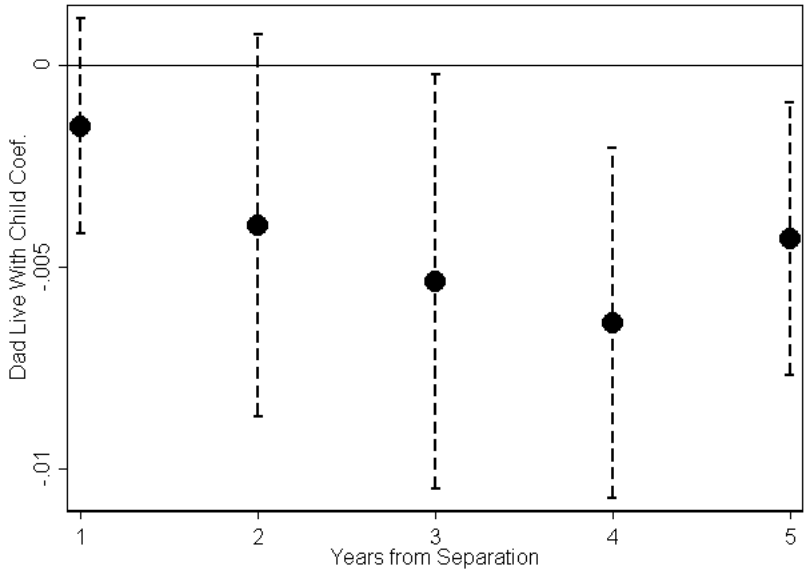
Notes: This figure shows the relationship between a non-custodial father's income and the required amount of child support by year for families with one child. Units are 1000s of nominal DKK.

Appendix Figure 2: Government-Mandated Child Support Obligations, 2 Child Families, Nominal DKK



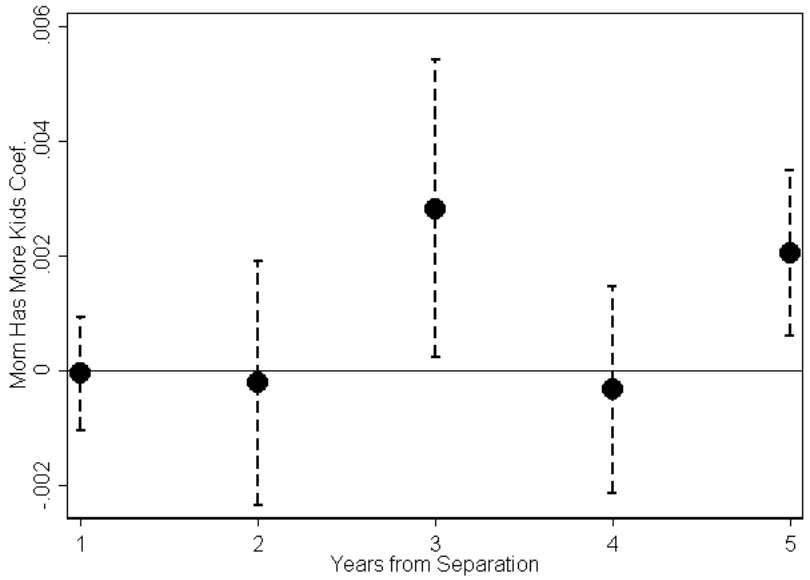
Notes: This figure shows the relationship between a non-custodial father's income and the required amount of child support by year for families with two children. Units are 1000s of nominal DKK.

Appendix Figure 3: The Effects of Child Support Obligations on Father-Child Co-Residence: By Year After Separation



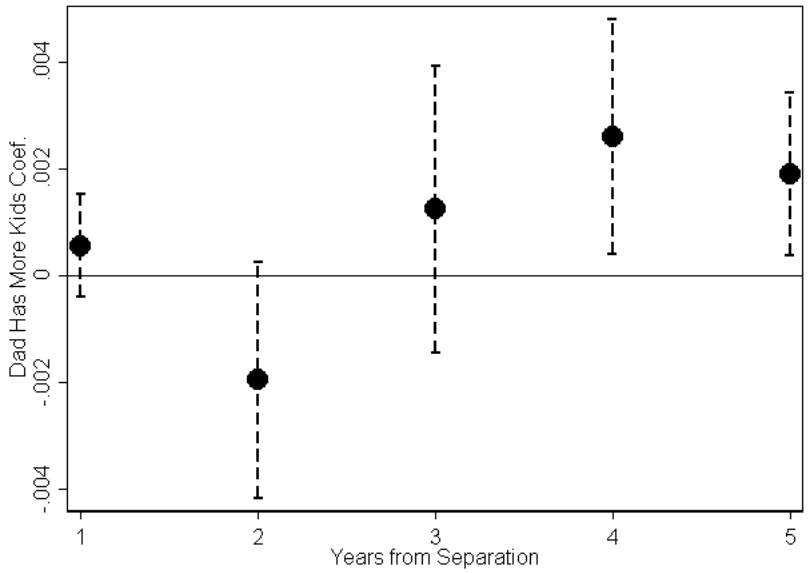
Notes: This figure presents the coefficients and 95% confidence intervals from five separate regressions. For years $x \in [1, 5]$, each regression has an indicator for the father living with his oldest child in year $x + 1$ post-separation as the dependent variable and the average annual obligation over the preceding post-separation years (0 to x) as the explanatory variable (instrumented by the average predicted obligation which is calculated using separation-year income and separation-year number of children). See notes under Table 2 for more information on the sample. All regressions include fixed effects for 20,000 DKK bins in the father's separation year income, number of children at separation, year of separation, and their double interactions. All regressions include controls (measured in the year of separation) for the father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the father being from Western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the mother being from Western Europe, mother's total income in year 2000 DKK, oldest child's age and age squared, youngest child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.

Appendix Figure 4: The Effects of Child Support Obligations on Mothers' Subsequent Fertility: By Year After Separation



Notes: This figure presents the coefficients and 95% confidence intervals from five separate regressions. In particular, for years $x \in [1, 5]$—the first five years of separation displayed on the x-axis—each regression has an indicator for the mother having more children in year $x + 1$ post-separation as the dependent variable and the average annual obligation over the preceding post-separation years (0 to x) as the explanatory variable (instrumented by the average predicted obligation which is calculated using separation-year income and separation-year number of children). See notes under Table 2 for more information on the sample, and notes under Appendix Figure 3 for more information on the estimation and controls.

Appendix Figure 5: The Effects of Child Support Obligations on Fathers' Subsequent Fertility: By Year After Separation



Notes: This figure presents the coefficients and 95% confidence intervals from five separate regressions. In particular, for years $x \in [1, 5]$—the first five years of separation displayed on the x-axis—each regression has an indicator for the father having more children in year $x + 1$ post-separation as the dependent variable and the average annual obligation over the preceding post-separation years (0 to x) as the explanatory variable (instrumented by the average predicted obligation which is calculated using separation-year income and separation-year number of children). See notes under Table 2 for more information on the sample, and notes under Appendix Figure 3 for more information on the estimation and controls.

Appendix Table 1: Child Support Obligation Schemes: 1999, 2005, 2008

1999: Normal Amount = 9,132 DKK; Extra Amount = 0 DKK

Obligation	Income Range (1 Child)	Income Range (2 Children)
Normal	<=275,000	<=290,000
Normal + 25% × Normal	275,001-290,000	290,001-315,000
Normal + 50% × Normal	290,001-315,000	315,001-355,000
Normal + 100% × Normal	>315,000	>355,000

2005: Normal Amount = 10,824 DKK; Extra Amount = 1,392 DKK

Obligation	Income Range (1 Child)	Income Range (2 Children)
Normal + Extra	<=325,000	<=345,000
Normal + Extra + 25% × Normal	325,001-345,000	345,001-380,000
Normal + Extra + 50% × Normal	345,001-380,000	380,001-420,000
Normal + Extra + 100% × Normal	380,001-500,000	420,001-600,000
Normal + Extra + 200% × Normal	500,001-900,000	600,001-1,100,000
Normal + Extra + 300% × Normal	>900,000	>1,100,000

2008: Normal Amount = 11,628 DKK; Extra Amount = 1,500 DKK

Obligation	Income Range (1 Child)	Income Range (2 Children)
Normal + Extra	<=350,000	<=370,000
Normal + Extra + 25% × Normal	350,001-370,000	370,001-405,000
Normal + Extra + 50% × Normal	370,001-405,000	405,001-450,000
Normal + Extra + 100% × Normal	405,001-600,000	450,001-700,000
Normal + Extra + 200% × Normal	600,001-1,000,000	700,001-1,200,000
Normal + Extra + 300% × Normal	>1,000,000	>1,200,000

Notes: Information on the child support schemes comes from from *Statsforvaltningen*. For more information, please see http://www.statsforvaltningen.dk/site.aspx?p=6404.

Appendix Table 2: Summary Statistics

	(1) All Sep.	(2) Prev. Mar.	(3) Prev. Coh.	(4) Never Mar/Coh
Average child support paid	9.211	10.19	9.025	5.735
	(8.509)	(9.529)	(7.711)	(5.136)
Average actual tax-ded. obligation	17.50	18.35	17.93	12.35
	(8.520)	(9.326)	(7.752)	(5.280)
Average predicted tax-ded. obligation	15.18	15.86	15.48	11.15
	(7.126)	(7.847)	(6.715)	(2.788)
1st child's age at sep.	6.922	9.647	5.682	0
	(5.586)	(5.421)	(4.335)	(0)
Dad age at sep.	36.33	39.69	34.34	29.50
	(7.581)	(7.060)	(6.532)	(5.972)
Dad inc. at sep.	286.3	298.6	279.7	258.6
	(71.92)	(72.88)	(68.73)	(68.45)
Dad ed: uni/college	0.133	0.161	0.111	0.0939
	(0.339)	(0.368)	(0.314)	(0.292)
Dad ed: short high-ed/vocational	0.551	0.565	0.554	0.476
	(0.497)	(0.496)	(0.497)	(0.499)
Dad ed: high school	0.0345	0.0355	0.0303	0.0463
	(0.183)	(0.185)	(0.171)	(0.210)
Mom age at sep.	34.14	37.17	32.40	27.78
	(7.111)	(6.335)	(6.497)	(5.934)
Mom inc. at sep.	205.6	224.7	196.2	161.2
	(73.19)	(73.07)	(68.48)	(63.97)
Mom ed: uni/college	0.197	0.231	0.176	0.133
	(0.398)	(0.422)	(0.381)	(0.339)
Mom ed: short high-ed/vocational	0.432	0.481	0.416	0.287
	(0.495)	(0.500)	(0.493)	(0.452)
Mom ed: high school	0.0528	0.0454	0.0547	0.0769
	(0.224)	(0.208)	(0.227)	(0.266)
Obs.	73,325	34,663	30,481	8,181

Notes: All income variables are in year 2000 real units of 1,000 DKK. The sample is limited to fathers of children born in 1985-2010, who appear in the register data in every year over 1998-2010, and who were either married to, cohabiting with, or never-married/non-cohabiting with their oldest child's mother at the time of childbirth for children born in 1998 or later or in 1998 for children born before. For parents who were never-married/non-cohabiting, the year of separation refers to the year of their oldest child's birth. The sample is further limited to fathers who were either never-married/non-cohabiting and had a child between 1998 and 2008 or who separated or divorced from their oldest child's mother between 1999 and 2008, who had nominal incomes between 175,000 and 505,000 DKK in the year of separation (100,000 DKK surrounding the range of the first three thresholds), and who had either one or two children aged less than 18 at the time of separation.

Appendix Table 3: Child Support Payment Variables, More Details

	(1) All Sep.	(2) Prev. Mar.	(3) Prev. Coh.	(4) Never Mar/Coh
CS Paid as Pct. of Obligation	0.531	0.566	0.500	0.501
Zero CS Paid	0.193	0.190	0.176	0.272
CS Paid as Pct. of Obligation, no 0s	0.659	0.699	0.607	0.688
0 < CS Paid < Obligation	0.715	0.700	0.767	0.581
CS Paid >= Obligation	0.0919	0.109	0.0573	0.147
Obs.	73,325	34,663	30,481	8,181

Notes: This table reports the fraction of all individuals in each column that are in each of the categories denoted on the left-hand side. See notes under Appendix Table 2 for more information on the sample.

Appendix Table 4: IV Effects of Average Child Support Obligations on Average Child Support Paid in the Years After Separation, Different Polynomial Specifications

	Dep. Var.: Average Child Support Paid in Years After Sep.				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average child support obligation	0.456*** [0.0262]	0.538*** [0.0366]	0.582*** [0.0409]	0.545*** [0.0406]	0.507*** [0.0369]
Mean, dept. var.	9.251	9.251	9.251	9.251	9.251
Fst. Stage Coef.	0.575	0.678	0.625	0.734	0.841
Fst. Stage F-Stat	5189.7	2431.7	1972.2	2100.5	2619.5
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 5: IV Effects of Average Child Support Obligations on Father-Child Co-Residence After Separation, Different Polynomial Specifications

	Dep. Var.: Father Ever Lives w/ Child Post-Sep.				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average child support obligation	-0.00182 [0.00127]	-0.00693*** [0.00190]	-0.00636*** [0.00217]	-0.00764*** [0.00227]	-0.00594*** [0.00203]
Mean, dept. var.	0.278	0.278	0.278	0.278	0.278
Fst. Stage Coef.	0.575	0.678	0.625	0.734	0.841
Fst. Stage F-Stat	5189.7	2431.7	1972.2	2100.5	2619.5
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 6: IV Effects of Average Child Support Obligations on Average Child Support Paid in the Years After Separation, Different Bin Specifications

	Dep. Var.: Average Child Support Paid in Years After Sep.				
	(1) 50K Bins	(2) 25K Bins	(3) 20K Bins	(4) 15K Bins	(5) 10K Bins
Average child support obligation	0.522*** [0.0338]	0.528*** [0.0373]	0.507*** [0.0369]	0.516*** [0.0376]	0.525*** [0.0382]
Mean, dept. var.	9.251	9.251	9.251	9.251	9.251
Fst. Stage Coef.	0.776	0.812	0.841	0.845	0.857
Fst. Stage F-Stat	3167.4	2544.8	2619.5	2493.9	2431.6
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — indicators for 50,000 DKK bins, column 2 — indicators for 25,000 DKK bins, column 3 — indicators for 20,000 DKK bins, column 4 — indicators for 15,000 DKK bins, column 5 — indicators for 10,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 7: IV Effects of Average Child Support Obligations on Father-Child Co-Residence After Separation, Different Bin Specifications

	Dep. Var.: Father Ever Lives w/ Child Post-Sep.				
	(1) 50K Bins	(2) 25K Bins	(3) 20K Bins	(4) 15K Bins	(5) 10K Bins
Average child support obligation	-0.00467*** [0.00168]	-0.00594*** [0.00202]	-0.00594*** [0.00203]	-0.00750*** [0.00210]	-0.00615*** [0.00214]
Mean, dept. var.	0.278	0.278	0.278	0.278	0.278
Fst. Stage Coef.	0.776	0.812	0.841	0.845	0.857
Fst. Stage F-Stat	3167.4	2544.8	2619.5	2493.9	2431.6
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — indicators for 50,000 DKK bins, column 2 — indicators for 25,000 DKK bins, column 3 — indicators for 20,000 DKK bins, column 4 — indicators for 15,000 DKK bins, column 5 — indicators for 10,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 8: IV Effects of Average Child Support Obligations on Average Child Support Paid in the Years After Separation, Different Windows

	Dep. Var.: Average Child Support Paid in Years After Sep.				
	(1) 20K	(2) 40K	(3) 60K	(4) 80K	(5) 100K
Average child support obligation	0.491*** [0.0417]	0.480*** [0.0380]	0.461*** [0.0365]	0.489*** [0.0366]	0.507*** [0.0369]
Mean, dept. var.	9.369	9.357	9.320	9.302	9.251
Fst. Stage Coef.	1.013	0.960	0.929	0.885	0.841
Fst. Stage F-Stat	1811.1	2289.2	2568.4	2595.8	2619.5
Obs.	45583	54000	60632	66000	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample, specifications, and controls. Samples of analysis are chosen based on the following income windows surrounding the first three thresholds: column 1 — 20,000 DKK, column 2 — 40,000 DKK, column 3 — 60,000 DKK, column 4 — 80,000 DKK column 5 — 100,000 DKK. Standard errors robust to heteroskedasticity. Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 9: IV Effects of Average Child Support Obligations on Father-Child Co-Residence After Separation, Different Windows

	Dep. Var.: Father Ever Lives w/ Child Post-Sep.				
	(1) 20K	(2) 40K	(3) 60K	(4) 80K	(5) 100K
Average child support obligation	-0.00407 [0.00264]	-0.00342 [0.00238]	-0.00338 [0.00219]	-0.00481** [0.00211]	-0.00594*** [0.00203]
Mean, dept. var.	0.277	0.278	0.278	0.278	0.278
Fst. Stage Coef.	1.013	0.960	0.929	0.885	0.841
Fst. Stage F-Stat	1811.1	2289.2	2568.4	2595.8	2619.5
Obs.	45583	54000	60632	66000	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample, specifications, and controls. Samples of analysis are chosen based on the following income windows surrounding the first three thresholds: column 1 — 20,000 DKK, column 2 — 40,000 DKK, column 3 — 60,000 DKK, column 4 — 80,000 DKK column 5 — 100,000 DKK. Standard errors robust to heteroskedasticity. Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 10: IV Effects of Average Child Support Obligations on the Likelihood of Mothers Having Children After Separation, Different Polynomial Specifications

	Dep. Var.: Mother Has More Kids in Years After Sep.				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average child support obligation	0.00137 [0.000942]	0.00422*** [0.00115]	0.00467*** [0.00129]	0.00687*** [0.00116]	0.00600*** [0.000997]
Mean, dept. var.	0.185	0.185	0.185	0.185	0.185
Fst. Stage Coef.	0.576	0.681	0.628	0.738	0.843
Fst. Stage F-Stat	5105.4	2422.5	1960.1	2105.0	2612.0
Obs.	68940	68940	68940	68940	68940

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 11: IV Effects of Average Child Support Obligations on the Likelihood of Fathers Having Children After Separation, Different Polynomial Specifications

	Dep. Var.: Father Has More Kids in Years After Sep.				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average child support obligation	0.000671 [0.00100]	0.00401*** [0.00131]	0.00389*** [0.00145]	0.00775*** [0.00131]	0.00692*** [0.00116]
Mean, dept. var.	0.186	0.186	0.186	0.186	0.186
Fst. Stage Coef.	0.575	0.678	0.625	0.734	0.841
Fst. Stage F-Stat	5189.7	2431.7	1972.2	2100.5	2619.5
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 12: IV Effects of Average Child Support Obligations on Mothers' Post-Separation Labor Market Outcomes

	(1) Any Wage	(2) Log Wage	(3) Emp.	(4) Self-Emp.	(5) NILF
Average child support obligation	0.000851 [0.00102]	0.00881* [0.00464]	0.00121 [0.00118]	0.000398 [0.000590]	0.000662 [0.000829]
Mean, dept. var.	0.847	11.82	0.753	0.0237	0.0691
Fst. Stage Coef.	0.844	0.831	0.843	0.843	0.843
Fst. Stage F-Stat	2607.6	2409.2	2612.0	2612.0	2612.0
Obs.	68868	65524	68940	68940	68940

Notes: The outcomes are defined as follows: 1) "Any Wage" refers to the proportion of years the mother has any wage income post-separation, 2) "Log Wage" refers to the log of the mother's average annual wage income in the years post-separation, 3) "Emp." refers to the proportion of years the mother is employed in the private or public sector (not self-employed) post-separation, 4) "Self-Emp." refers to the proportion of years the mother is self-employed post-separation, and 5) "NILF" refers to the proportion of years the mother is not in the labor force post-separation. All income variables are in year 2000 real units of 1,000 DKK. See notes under Tables 2 and 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 13: IV Effects of Average Child Support Obligations on the Fraction of Years Fathers are Not in the Labor Force After Separation, Different Polynomial Specifications

	Dep. Var.: Proportion of Time NILF in Years After Sep.				
	(1) Poly 1	(2) Poly 2	(3) Poly 3	(4) Poly 4	(5) 20K Bins
Average child support obligation	0.0109*** [0.000453]	0.000646 [0.000530]	-0.000821 [0.000610]	0.00278*** [0.000656]	0.00209*** [0.000547]
Mean, dept. var.	0.0418	0.0418	0.0418	0.0418	0.0418
Fst. Stage Coef.	0.575	0.678	0.625	0.734	0.841
Fst. Stage F-Stat	5189.7	2431.7	1972.2	2100.5	2619.5
Obs.	70637	70637	70637	70637	70637

Notes: All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample and controls. The following functions of the father's real income in the year of separation are included: column 1 — linear polynomial, column 2 — quadratic polynomial, column 3 — cubic polynomial, column 4 — quartic polynomial, column 5 — indicators for 20,000 DKK bins. All regressions include the controls listed in the notes under Table 4 as well as a full set of fixed effects and interactions for number of children, year of separation, and the interactions between them and the father's income function. Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 14: IV Results Using Father's Income in Year *Before* Separation to Predict Average Obligations

	(1) Avg. CS Paid	(2) F. Live w/Child	(3) F. More Kids	(4) M. More Kids	(5) F. NILF
Average child support obligation	0.526***	-0.00414*	0.0107***	0.00781***	0.00227***
	[0.0434]	[0.00241]	[0.00134]	[0.00117]	[0.000713]
Mean, dept. var.	9.252	0.278	0.186	0.185	0.0403
Fst. Stage Coef.	0.772	0.772	0.772	0.776	0.772
Fst. Stage F-Stat	1527.3	1527.3	1527.3	1534.1	1527.3
Obs.	69009	69009	69009	67358	69009

Notes: "F." refers to fathers' outcomes, while "M." refers to mothers' outcomes. The results reported here are from specifications where average predicted obligations (which are used to instrument for actual average obligations) are calculated based on the father's income measured in the year *before* separation. All income variables are in year 2000 real units of 1,000 DKK. See notes under Appendix Table 2 and Table 4 for more information on the sample, specifications, and controls. Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 15: IV Effects of Average Child Support Obligations, 1-Child Families

	(1) Avg. CS Paid	(2) F. Live w/Child	(3) F. More Kids	(4) M. More Kids	(5) F. NILF
Average child support obligation	0.383*** [0.0415]	-0.00251 [0.00275]	0.0103*** [0.00154]	0.0148*** [0.00138]	0.00266*** [0.000884]
Mean, dept. var.	6.313	0.253	0.209	0.221	0.0470
Fst. Stage Coef.	0.871	0.871	0.871	0.885	0.871
Fst. Stage F-Stat	1679.7	1679.7	1679.7	1700.8	1679.7
Obs.	39021	39021	39021	37465	39021

Notes: "F." refers to fathers' outcomes, while "M." refers to mothers' outcomes. See notes under Appendix Table 2 on the sample. Here, the sample is further limited to parents who had one child at the time of separation. All income variables are in year 2000 real units of 1,000 DKK. All regressions include fixed effects for 20,000 DKK bins in the father's separation year income and the year of separation. All regressions include controls (measured in the year of separation) for the father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the father being from Western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the mother being from Western Europe, mother's total income in year 2000 DKK, the child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

Appendix Table 16: IV Effects of Average Child Support Obligations, 2-Child Families

	(1) Avg. CS Paid	(2) F. Live w/Child	(3) F. More Kids	(4) M. More Kids	(5) F. NILF
Average child support obligation	0.355***	-0.00485*	0.00455***	0.00484***	-0.000147
	[0.0587]	[0.00281]	[0.00170]	[0.00144]	[0.000637]
Mean, dept. var.	12.88	0.309	0.157	0.142	0.0354
Fst. Stage Coef.	0.258	0.258	0.258	0.257	0.258
Fst. Stage F-Stat	1168.9	1168.9	1168.9	1170.9	1168.9
Obs.	31616	31616	31616	31475	31616

Notes: "F." refers to fathers' outcomes, while "M." refers to mothers' outcomes. See notes under Appendix Table 2 on the sample. Here, the sample is further limited to parents who had two children at the time of separation. All income variables are in year 2000 real units of 1,000 DKK. All regressions include fixed effects for 20,000 DKK bins in the father's separation year income and the year of separation. All regressions include controls (measured in the year of separation) for the father's age and age squared, dummies for the father's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the father being from Western Europe, mother's age and age squared, dummies for the mother's education (less than high school, high school, vocational/short-term higher ed, college/university, and missing), an indicator for the mother being from Western Europe, mother's total income in year 2000 DKK, the oldest child's age and age squared, the youngest child's age and age squared, and indicators for original parental relationship status (married, cohabiting, never-married/non-cohabiting). Additionally, the regressions include indicators for the number of children still under age 18 in each year post-separation that the parents had (not including any new children born post-separation). Standard errors robust to heteroskedasticity.
Significance levels: * p<0.1 ** p<0.05 *** p<0.01

B A Theoretical Model

In Section 3, we described some mechanisms by which fathers' child support obligations may impact parental behavior. Here, we formalize these channels using a model. Our framework draws on several existing models of interaction between divorced and unmarried parents (e.g., Weiss and Willis, 1985; Del Boca and Flinn, 1995; Willis, 1999; Flinn, 2000; Del Boca and Ribero, 2003; Roff and Lugo-Gil, 2012).

Consider a set of separated parents with one child between them, where mothers are denoted by subscript m and fathers are denoted by subscript f. Each parent obtains utility from child quality, Q, their own private adult consumption, C, and their leisure time, L.[39] Utility from child quality is comprised of two components: Q^0 (current child quality) and Q^1 (child quality from a possible subsequent child born within a new union). For simplicity, we do not explicitly model future children born outside marriage/cohabitation; however, we discuss how incorporating this decision into the model would affect the main conclusions below. For each parent $i \in \{m, f\}$, denote the number of subsequent children by n_i, where n_i can take on integer values $\{0, 1, 2, \ldots\}$.

Additionally, assume that child quality is a function of two types of investments: financial, F, and time, K. Denote the financial and time investments in the current child by F^0 and K^0, respectively. For mothers' subsequent children, financial and time investments are F_m^1 and K_m^1, respectively; for fathers' subsequent children, financial and time investments are F_f^1 and K_f^1, respectively. We do not make any assumptions about whether the financial and time investments are substitutes or complements in the child quality function; although we discuss the implications of such assumptions further below.

In terms of time allocation, each parent must divide his/her time between work in the labor market (denoted by H), time investments into children, and leisure. Each parent $i \in \{m, f\}$ earns wage w_i in the labor market, and total time available is denoted by T.

We assume that the separated parents do *not* bargain cooperatively and instead face a static Stackelberg game.[40] In this setting, the non-custodial father can make two types of transfers to the

[39] Note that our framework differs from the model in Neal (2004), which assumes that "absent fathers do not enjoy any consumption gains from having children". We instead follow Willis (1999) and Flinn (2000) (among many others) by assuming that non-custodial fathers in fact obtain utility from child quality. This assumption is arguably more realistic in our setting, where an estimated 20 percent of Danish children with divorced or separated parents have fathers who share in their physical custody (Bjarnason and Arnarsson, 2011), and another 45 percent have non-custodial fathers who visit with them at least every other weekend (Kampmann and Nielsen, 2004).

[40] The non-cooperation assumption is common in the literature on non-intact families (e.g., Weiss and Willis, 1985; Del Boca and Flinn, 1995; Willis, 1999; Roff and Lugo-Gil, 2012). In an important contribution, Flinn (2000) instead develops a model where separated parents can choose between cooperative and non-cooperative equilibria, and where institutions (e.g., judges determining child support or custody settlements) are modeled as coordination devices. Such a model is useful for generating predictions about the impacts of changes to institutional enforcement

custodial mother: a financial transfer, s, and a time transfer, t. The custodial mother chooses how to allocate these transfers. Intuitively, we can think of the time transfer as the amount of extra time freed up for the mother as a result of the father offering to spend time with the child.[41]

For subsequent children, we assume that the parents expect to bargain cooperatively with new partners. Each parent i expects to be responsible for fraction λ_i^F of the total financial investment and fraction λ_i^K of the total time investment per subsequent child born.

More concretely, $\forall i \in \{m, f\}$ parental utility is represented by the following function:

$$U\Big(Q^0, Q_i^1, n_i, C_i, L_i\Big) = \beta_i U_c\Big(Q^0(F^0, K^0),\ \ n_i * Q^1(F_i^1, K_i^1)\Big) + (1-\beta_i)U_a\Big(C_i, L_i\Big)$$

where $U_c(\cdot)$ represents utility from children, $U_a(\cdot)$ represents utility from adult activities, and β_i, $0 < \beta_i < 1$, represents the weight each parent places on his/her preferences toward children relative to other adult consumption goods.[42]

The mother chooses the optimal current and subsequent child investments, the number of subsequent children she will have, and her own adult consumption and leisure, conditional on the father's transfers, s and t:[43]

$$\max_{F^0, K^0, n_m, F_m^1, K_m^1, C_m, L_m} \beta_m U_c\Big(Q^0(F^0, K^0),\ \ n_m * Q^1(F_m^1, K_m^1)\Big) + (1-\beta_m)U_a\Big(C_m, L_m\Big)$$

$$\text{s.t.} \quad F^0 + n_m \lambda_m^F F_m^1 + C_m = w_m\Big(T - L_m - K^0 + t - n_m \lambda_m^K K_m^1\Big) + s$$

The father then maximizes his indirect utility function, taking into account the maternal optimal response functions for current child investments, $F^0(s,t)^*$ and $K^0(s,t)^*$. He chooses his optimal financial and time transfers for the current child, the number of subsequent children he will have,

capabilities. For example, a key result of the model is that when institutions can perfectly enforce compliance with child support obligations, the custodial parent loses the incentive to engage in cooperative behavior; for a large set of parental preferences, perfect child support enforcement can thus lead to lower child investments relative to imperfect enforcement. In our case, the empirical analysis uses variation in child support obligation *amounts*, rather than in the degree of institutional enforcement (in fact, enforcement does not change throughout our sample time frame). As such, we do not take this approach, and instead assume perfect complicance with child support obligations (see below).

[41] This set-up implicitly assumes that maternal and paternal time investments are perfect substitutes. Instead, it may be that mothers view paternal time investments as less productive than their own. Such an assumption can be modeled by multiplying t by some parameter $0 < \rho < 1$ in the mother's maximization problem below. Alternatively, mothers may place greater weight on paternal time investments if they think it is important for children to spend time with a male role model. This assumption can be modeled by multiplying t by some parameter $\rho > 1$ in the mother's maximization problem. The main conclusions of the model remain qualitatively similar.

[42] While we do not make any assumptions about a particular functional form of the utility function in this discussion, we note that the utility function in this framework must allow for corner solutions as n_i is allowed to be set to zero. More formally, it must be that $\lim_{x \to 0} U'(x) \neq \infty$.

[43] Prices of consumption goods are normalized to 1 for simplicity.

his investments into subsequent children, his private adult consumption, and his time spent in leisure. Additionally, we assume that for the current child, the father is subject to a child support mandate, R, which depends on his earned income, his number of children, and his time transfer, and is defined further below. The father thus solves the following problem:

$$\max_{s,t,n_f,L_f,F_f^1,K_f^1} \Bigg\{ \beta_f U_c\Big(Q^0(F^0(s,t)^*, K^0(s,t)^*),\ \ n_f * Q^1(F_f^1, K_f^1)\Big)$$

$$+(1-\beta_f) U_a\Big(w_f(T - L_f - t - n_f\lambda_f^K K_f^1) - s - n_f\lambda_f^F F_f^1,\ \ L_f\Big)\Bigg\} \qquad \text{s.t.} \quad s \geq R(w_f H_f, n_f, t)$$

The child support obligation for the current child, $R(w_f H_f, n_f, t)$, is set according to a formula that depends on the father's earned income, $w_f H_f$, his total number of biological children $(n_f + 1)$, and his time transfer, t, in a way similar to the actual Danish child support guidelines that we study. In particular,

$$R(w_f H_f, n_f, t) = \begin{cases} \xi & \text{if} \quad w_f H_f \leq \overline{Y}_{n_f} \quad \text{and} \quad t \leq \bar{t} \\ \xi + \tau & \text{if} \quad w_f H_f > \overline{Y}_{n_f} \quad \text{and} \quad t \leq \bar{t} \\ 0 & \text{if} \quad t > \bar{t} \end{cases}$$

for some $\xi > 0$, $\tau > 0$, and $\bar{t} > 0$. Additionally, $\overline{Y}_{n_f} > 0$ and is strictly increasing in n_f. In other words, the guidelines are set such that fathers must pay a base amount, ξ, and fathers with incomes above some threshold, $\overline{Y}_{n_f}$, face an additional obligation of τ. The location of $\overline{Y}_{n_f}$ is increasing with the father's subsequent number of children, n_f. The child support constraint is removed once fathers make high enough time transfers, t. For example, in our context, fathers who share equally in physical custody of their children do not need to pay child support.

Denote the father's optimal financial transfer by:

$$s^* = \max\Big(s^{unc},\ R(\cdot)\Big)$$

where s^{unc} is the (unconstrained) solution to the father's optimization problem if the child support mandate constraint is not binding.[44]

[44] As noted, we assume perfect compliance with child support mandates and do not model the compliance decision. This decision is modeled explicitly through an incorporation of a cost associated with non-compliance in Del Boca and Flinn (1995) and Flinn (2000). Modeling the compliance decision is important in a setting where the degree of institutional enforcement changes and child support obligations are set endogenously (e.g., by judges). In our case, enforcement is stable over the analysis time frame, and we argue that our variation in child support obligations is policy-driven and exogenous.

B.1 Possible Effects on Parental Behaviors

Consider two child support obligation schemes: $R_1(w_f H_f, n_f, t)$ and $R_2(w_f H_f, n_f, t)$, with $\xi_2 > \xi_1$ and $\tau_2 > \tau_1$. What happens to parental behaviors when we increase the child support obligation from R_1 to R_2? Our model highlights the theoretical ambiguity of this question with regard to the following parental behaviors:

Fathers' Financial Transfers Consider three possible cases that depend on what fathers' financial transfers would have been in the absence of government intervention:

First, if $s^{unc} \geq R_2$, the father optimally transfers as much or more than what is mandated under the higher obligation, R_2. This father will not alter s^* in response to a switch from the lower to the higher obligation.

Second, if $R_1 < s^{unc} < R_2$, then the father would optimally pay more than the lower obligation, R_1, but less than the higher obligation, R_2. When faced with a change from R_1 to R_2, it may be optimal for the father to increase s^* from s^{unc} to R_2. The magnitude of this increase is strictly less than the difference between the two schemes, $R_2 - R_1$. However, as discussed further below, some fathers may also respond by having more children or lowering their labor supply so to reduce their R_2 obligations from $\xi_2 + \tau_2$ to ξ_2. If $\xi_2 < s^{unc} < \xi_2 + \tau_2$, then there may be a decrease in s^* from s^{unc} to ξ_2.

Third, if $s^{unc} \leq R_1$, then the father would optimally pay less than the lower obligation. There are two possibilites for these fathers as well. Some fathers may increase s^* exactly from R_1 to R_2 (either from ξ_1 to ξ_2 or from $\xi_1 + \tau_1$ to $\xi_2 + \tau_2$). However, as before, if some fathers respond by having more children or lowering their labor supply, s^* may instead change from $\xi_1 + \tau_1$ to ξ_2, which may reflect either an increase or a decrease in optimal payments, depending on whether ξ_2 is smaller or larger than $\xi_1 + \tau_1$.

Thus, while increases in child support obligations are predicted to increase some fathers' financial transfers to their children, this relationship is complicated by other paternal behaviors, and may not be one-for-one on average. Some fathers may just substitute for non-mandated transfers that they would have made in the absence of government intervention. Additionally, fertility and labor supply responses may even lead to a perverse relationship between child support mandates and actual payments.

Fathers' Time Investments There are two opposing forces on fathers' time investments. On the one hand, since fathers who make high enough time transfers do not face the child support

mandate, a higher obligation may lead to an increase in t^* as the father can forego a larger financial cost by being above $\bar{t}$. Additionally, if the higher obligation increases the father's financial transfer, then paternal time transfers may also increase if financial and time investments are complements in the child quality function.

On the other hand, a higher obligation increases the maternal incentive to actually receive the higher mandated financial transfer by ensuring (via her optimal response functions) that the father's time transfer does not exceed $\bar{t}$. In our setting, when the father is faced with the higher obligation, the mother has a greater incentive to make sure that the father does not share in physical custody.[45] Moreover, as above, the impacts on time transfers also depend on the child quality function, and there may be additional downward pressure on paternal optimal time transfers, if financial and time investments are substitutes.

Both Parents' New Family Formation Fathers face complex fertility incentives. First, for fathers with incomes below the threshold, $\overline{Y}_{n_f}$, a higher obligation represents a negative income effect, which may decrease subsequent fertility. However, since the income threshold is increasing in the number of subsequent children, and since the father is only mandated to make financial transfers to his one existing non-custodial child, some (higher-income) fathers have an incentive to have more children so to reduce their child support obligation from $\xi + \tau$ to ξ. Additionally, for fathers at all income levels, higher obligations may lead to less time spent with existing children, t^*, freeing up time available to invest in future children.

For mothers, consider the case where higher obligations increase fathers' financial transfers. For them, higher obligations constitute larger positive income effects, resulting in greater investments in current children as well as greater demand for subsequent children. Mothers also face an opposite incentive to lower subsequent fertility because their time available to invest in subsequent children may be lower as a result of a reduction in the paternal time transfer.

Moreover, although we do not model this explicitly, there are different incentives for mothers' and fathers' subsequent fertility *outside* marriage and cohabitation. In particular, although a father may lower his per-child obligation by having more children out-of-wedlock/cohabitation (since the income threshold is increasing in his total number of children), fertility within unions is relatively

[45] In practice, parents can either agree on a custody arrangement or go to the court if they are unable to reach an agreement. Hence, if the mother refuses to share physical custody, the father can in principle take the issue to court. However, prior to a reform in October 2007, which made joint legal custody the default determination (and hence made joint physical custody more likely as well), courts were likely to rule in favor of maternal sole custody. Thus, it is reasonable to assume that, during our sample time frame of 1999-2008, mothers had substantial influence over the custody decision.

less costly as he is only subject to child support mandate for his out-of-union children. By contrast, a mother may have larger incentives for childbearing outside unions because the receipt of a higher payment for her existing child may increase her expectation of child support transfers associated with subsequent offspring from new partners.[46]

Both Parents' Labor Market Behavior Fathers face opposing labor supply incentives. For a father with earnings below the threshold, $\overline{Y}_{n_f}$, the child support obligation is a flat negative income shock in the amount of ξ. This shock is predicted to reduce demand for leisure and increase labor supply. In contrast, a father with an income above the threshold faces a type of tax on earnings. This higher-income father has an incentive to lower his labor supply in order to reduce his income and avoid paying the additional τ amount.

For a mother, again consider the case where a higher obligation increases the father's financial transfer. The child support obligation is then a positive income shock that is not dependent on her own earned income. As such, we may expect an increase in maternal demand for leisure and therefore a reduction in her labor supply. Additionally, maternal labor supply may also be affected by possible changes to her time available to work due to impacts on the father's time transfer.

C Evidence on Physical Custody Arrangements, In-Kind Transfers, and Child Support Payments from Survey Data

In Section 4, we argue that an important factor driving the zero payments we observe in our data is joint physical custody arrangements. Unfortunately, the administrative data we use contain an imperfect measure of physical custody based on whether the child is registered at the same address as the parent. As children can only have one address in our data (irrespective of their custody arrangement), we underestimate joint physical custody arrangements by looking at children who are registered at the same address as their fathers.

To further examine the relationship between physical custody arrangements and child support payments, we link our administrative data to survey data from Denmark. As sample sizes for children living in non-intact families in available surveys are small, we pool data from two sources: first, the 2007 wave of the *Danish longitudinal survey of children (DALSC)*, and second, the 2009

[46]Note that all of these fertility responses for fathers and mothers are relevant insofar as we hold the fertility responses of the other parents constant. As these parents are all arguably in the same matching market post-separation, the net effects on overall parental fertility rates also depend on the numbers of men and women and their relative bargaining powers.

wave of the *Children and Youth in Denmark (CYD)* survey.[47] The DALSC is a panel study of all children born in Denmark in one week of October 1995. The CYD is a survey conducted among random samples of seven cohorts aged 3-19 in 2009 and 2013. Both panel studies examine a broad set of topics related to children's living conditions, including custody arrangements.

We link the survey information to the administrative data on child support payments. Similar to our sample construction described in Section 4, we keep children whose fathers are in the administrative data in all years after 1995 (the initiation year of the DALSC). We match 5,738 DALSC and 5,988 CYU children to the administrative data (99/95% of the children with completed survey questionnaires). In 2007, the DALSC children were 12 years old and thus we have a relatively large share of children who have experienced a parental separation: After conditioning on the fathers being in the data for all years after 1995 and experiencing a separation at any time during the period, we end up with 2,024 separated fathers with (singleton) children. For the CYD data, we end up with 1,428 fathers.

As we use parental reports on physical custody arrangements (the vast majority of questionnaires were completed by mothers), we further condition on the parents having answered questions on the custody arrangements (i.e., separated before the surveys in 2007/2009). Finally, we only look at one- and two-children families with fathers in the relevant income range (around the guideline thresholds), as in the main analysis. Our final survey sample consists of parents of 843 (DALSC)/765 (CYD) children.

Appendix Table 17 divides this sample of children into three groups: Column 1 reports summary statistics for the full survey sample of separated parents. Columns 2 and 3 show summary statistics for the two sub-groups: children with sole-mother and children with either joint or sole-father physical custody arrangements as reported in the respective survey years (2007 for DALSC and 2009 for CYD). Joint physical custody is defined as the child spending approximately half of the time with each parent (in the survey year). Given that we only have 49 fathers with sole physical custody in our data, and as paternal child support obligations do not apply to both joint and sole physical custody fathers, we pool the two groups.

In the top panel, we report means and standard deviations of some of the child support variables from the administrative data. While our main analysis focuses on fathers' child support obligations and payments, we also describe maternal child support payments here as they are especially relevant for the joint and sole-father physical custody arrangements.

[47] For details on the DALSC and CYU please see http://www.sfi.dk/about_the_research-11402.aspx and http://www.sfi.dk/children_and_young_people_in_denmark-7395.aspx.

We find that fathers who share in the physical custody in the survey year (and especially if they have sole custody) pay less child support over the separation time relative to fathers who do not. The percentage of fathers with zero payments is higher among fathers who have sole or joint physical custody in the survey year: 46 percent of sole- or joint-custody fathers make zero payments in that year (relative to 35 percent of fathers whose children live in sole-mother custody arrangements). These figures illustrate that a large share of the zeros we observe in our administrative data is likely driven by fathers who share in physical custody of their children.

Additionally, while the 21 percent of fathers with joint or sole physical custody in the survey year pay less than their non-custody counterparts, the survey data also show that mothers pay more in these cases: Mothers of children in sole-father or joint physical custody arrangements pay more than four times as much as sole-custody mothers, and are less likely to ever have zero payments after separation. However, the relatively low level of average post-separation mother payments reflects that mothers are most likely to have physical custody of their children in some (if not all) of the pre-survey separation years.

The last row in the top panel shows that our measure of father-child co-residence—an indicator for the father having the same address as the child in any year post-separation—is reasonable (although imperfect). Fathers who have joint or sole physical custody are more likely to be registered at the same address as their child relative to fathers of children in sole-mother custody arrangements.

Finally, the lower panels of the table focus on variables only available in two waves of the DALSC. First, we look at the same sample of children in the 2007 DALSC and their parents' reports from any of the survey years (1996, 1999, 2003, 2007, 2011). These data show that joint physical custody arrangements are relatively fluid over separation time: among parents who have a sole-mother arrangement in 2007, 13 percent have joint custody in any of the survey years. Overall, 33 percent of parents have a joint custody arrangement in at least one of the survey years.

Second, we use the 1999 DALSC wave to look at the prevalence of gifts and other in-kind transfers between separated parents.[48] We find that in-kind transfers are relatively uncommon: 18 percent of fathers have bought winter clothing for their children and only around four percent of fathers contributed to the costs of child care.

In sum, using the available survey data (linked to our administrative data), we find that joint (and sole-father) physical custody arrangements (which we underestimate when using only administrative data on addresses) coincide with lower average father child support payments, higher

[48] Unfortunately, we only have survey information on this topic in the 1999 wave of the survey. In this year, the DALSC children are three years old and thus we have even fewer children in families which have separated.

prevalence of zero payments by fathers, and higher average mother payments. Moreover, as around 33 percent of parents have a joint physical custody arrangement at some point post-separation, and as parents sharing physical custody do not face child support mandates, we conclude that a large percentage of the observed zero-payments in our main analysis data set is attributable to the prevalence of these arrangements. Finally, in-kind transfers between parents (that are not included in the mandated or voluntary child support payments that we observe) appear to be relatively uncommon in the Danish setting.

Appendix Table 17: Physical Custody Arrangements and Child Support Payments: Evidence from Administrative Data Linked to Survey Data from DALSC (1999, 2007) and CYD (2009)

	DALSC (2007) and CYD (2009) samples, admin. data		
	(1)	(2)	(3)
	All parents	Mother	Joint and Father
Father: Child support payments in survey year	11.30	11.67	9.893
	(12.10)	(12.24)	(11.47)
Father: Zero child support in survey year	0.368	0.345	0.455
	(0.482)	(0.476)	(0.499)
Father: Average child support paid after sep.	11.40	11.85	9.687
	(9.746)	(9.697)	(9.758)
Father: Ever zero child support after sep.	0.704	0.684	0.781
	(0.457)	(0.465)	(0.414)
Father: Always zero child support after sep.	0.160	0.141	0.237
	(0.367)	(0.348)	(0.426)
Father: Average child support obligation	23.75	23.35	25.27
	(10.16)	(9.916)	(10.92)
Mother: Average child support paid after sep.	1.036	0.600	2.699
	(3.211)	(2.331)	(5.048)
Mother: Ever zero child support after sep.	0.973	0.986	0.922
	(0.163)	(0.118)	(0.268)
Father: Ever lives with the child after sep.	0.249	0.239	0.287
	(0.433)	(0.427)	(0.453)
Obs.	1,608	1,274	334
	Survey data, DALSC (2007)		
	(1)	(2)	(3)
Joint physical custody, any survey year	0.325	0.130	0.840
	(0.469)	(0.336)	(0.367)
Obs.	819	594	225
	Survey data, DALSC (1999)		
	(1)	(2)	(3)
Father has bought winter clothing	0.188	0.178	0.269
	(0.391)	(0.383)	(0.448)
Father has paid for child care	0.0402	0.0285	0.135
	(0.197)	(0.167)	(0.345)
Obs.	473	421	52

Notes: Columns 2-4 divide the sample by the physical custody arrangement (sole-mother, sole-father, joint) in the survey year (2007/2009).