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Family Income Dynamics, Early Childhood Education and Care, and Early Child Behavior Problems in Norway

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Abstract

The sociopolitical context of Norway includes low poverty rates and universal access to subsidized and regulated Early Childhood Education and Care (ECEC). In this context, the association between family income dynamics and changes in early child behavior problems was investigated, as well as whether high quality ECEC buffers children from the effects of income dynamics. In a population-based sample ($N = 75,296$), within-family changes in income-to-needs predicted changes in externalizing and internalizing problems (from age 18 to 36 months), particularly for lower-income children. For internalizing problems, ECEC buffered the effect of income-to-needs changes. These findings lend further support to the potential benefits of ECEC for children from lower-income families.

Low family income has been associated with delay or dysfunction in nearly all domains of children's development, including child behavior problems (Dearing, 2014). Links between economic deprivation and child behavioral dysregulation may be mediated, in large part, by the home environment, through processes often referred to as the "economic stress" or "family stress" model (for review, see Yoshikawa, Aber, Bergman, & Beardslee, 2012). According to this model, low family income heightens the risk for stress in the home environment, resulting in heightened levels of conflict, parenting strain, and chaos (Dearing, 2014; Evans, 2004). The elevated stress within the home and its effects on parenting – increased harshness and decreased consistency – is believed to undermine emotional well-being and efforts to regulate negative emotions (Conger & Donnellan, 2007; Elder, Jr., Nguyen, & Caspi, 1985). Efforts to promote healthy development in children from low-income families may therefore target either the family's economic situation or the family stress processes, or provide more supportive environments for these children outside of the family. One such protective context outside the home may be high-quality Early Childhood Education and Care (ECEC; Yoshikawa et al, 2012).

Family Income Dynamics and Child Behavior

Economic well-being is often in flux for low-income families, and recent evidence suggests that the home environment and, in turn, child behavior is responsive to gains and losses in family income (Dearing & Taylor, 2007; Votruba-Drzal, 2006). In addition to comparing economically-disadvantaged children with more advantaged children (i.e., between-family studies), child development researchers have recently begun to focus on within-family studies of income dynamics and child outcomes, over time (for reviews, see Gennetian, Castells, & Morris, 2010; Yoshikawa et al., 2012). This work adds to the cumulative knowledge for three reasons, primarily. First, studying change is a matter of ecological validity; given that economic well-being is often in flux rather than stable for low-income families, capturing these dynamics could be critical for understanding children's experiences and growth, in context. Second, within-family studies of income dynamics may help estimate the effects of policies that improve family economic conditions, directly (e.g., cash transfer) or indirectly (e.g., improved pay). Third, although often capturing income fluctuations in non-experimental designs, studies of income dynamics are useful for disentangling the effect of low income per se from stable characteristics of the child, family, and greater context (e.g., low human capital).

A few studies in the U.S. have examined within-family changes in family income as a predictor of within-child changes in behavior and well-being. Statistically, the approach is referred to "fixed-effects" estimation, because all factors that are "fixed" (i.e., time-invariant) – such as stable endogenous child, family, or context qualities – cannot bias the estimates (e.g., McCartney, Burchinal, & Bub, 2006). Using this approach, gains in income for low-income families have been associated with improvements in the quality of the environment as well as decreases in externalizing and internalizing behavior problems across early childhood, ages 2 to 5 years (Dearing, McCartney, & Taylor, 2006; Dearing & Taylor, 2007). Using a comparable statistical approach, Votruba-Drzal (2006) found similar effects on a global measure of behavior problems in older children (5 to 12 years of age).

Quasi-experimental designs yield similar results. D'Onofrio et al. (2009) found that levels of conduct problems differed for siblings and cousins in the age range 4 to 11 years as a function of family income changes over time; siblings and cousins who experienced low levels of income displayed more conduct problems than their siblings and cousins who experienced higher income during this period. Moreover, in a natural experiment among older children, increases in income on an American Indian reservation following the opening of a casino resulted in decreased psychiatric symptoms (Costello, Compton, Keeler, & Angold, 2003). Likewise, a study exploiting experimental studies of welfare-reforms found increases in family income increased positive social behavior (Morris & Gennetian, 2003). From an international perspective, however, this line of work is limited by its nearly exclusive focus on children in the U.S., which compared to many other developed countries, particularly in northern Europe, is characterized by higher poverty rates, more children experiencing severe poverty, greater inequality between the richest and poorest families, and a relatively limited social welfare system (UNICEF Innocenti Research Center, 2012). Little is known about whether the effects of income changes can be generalized to children growing up in more progressive welfare states.

Within the existing line of work, there has also been some consideration of potential moderators of income dynamics. That is, do certain conditions or events accentuate or attenuate associations between income gains/losses and child behavior problem declines/increases? To date, however, most of this work has been on potential moderators operating within the home context. For instance, Dearing et al. (2006) found that income gains were more strongly associated with improvements in children's internalizing and externalizing problems when they had been chronically poor and their mothers were both employed and partnered. This work on moderators within the home was focused primarily on understanding interactions between income and the various mechanisms that may give rise to economic changes. Moderators operating outside of the home might also alter the consequences of income changes; potential buffers from the negative effects of income losses would be of particular value from an intervention and prevention standpoint. In the present study, we extend the line of work addressing income dynamics by examining a salient developmental context outside of the home, namely ECEC, as a potential moderator.

Early Childhood Education and Care as Moderator of Income Dynamics Consequences?

ECEC programs including center-based infant- and toddler care, are increasingly espoused as a valuable means of reducing social inequality in child development (e.g., European Commission, 2011), with robust evidence of benefits for children from low-income families in achievement domains (e.g., Geoffroy et al., 2010; Magnuson, Ruhm, & Waldfogel, 2007). Yet, whether ECEC might also have benefits for low-income children's behavior in the early years is less clear. High-quality ECEC may provide a stable and nurturing context for low-income children that would otherwise not be available to them and that reduces exposure to stress in the home environment, hence promoting behavioral regulation and reducing behavior problems (Votruba-Drzal, Coley, & Chase-Lansdale, 2004). Moreover, there is evidence that access to high-quality child care reduces parenting stress and promotes sensitive care in the homes of low-income families (McCartney, Dearing, Taylor, & Bub, 2007).

High quantities of non-parental care have, on the other hand, been associated with elevated levels of externalizing behavior problems in studies not specifically addressing children from low-income families (NICHD Early Child Care Research Network, 2003). Yet, a study taking a fixed-effects approach to this issue casts doubt on whether quantity of care is, in fact, causally related to behavior problems in the US (McCartney, Burchinal, Clarke-Stewart, Bub, Owen, & Belsky, 2010). Furthermore, two recent studies from Norway, with a very different ECEC- and parental leave context, fail to demonstrate associations between high quantities of care and externalizing problems being robust, either when using covariate-adjusted regression methods (Solheim, Wichstrom, Belsky, & Berg-Nielsen, 2013), or sibling- and within-person fixed-effects (Zachrisson, Dearing, Lekhal, & Toppelberg, 2013) to account for selection into ECEC.

Also, in studies specifically addressing consequences of ECEC utilization in children from low-income families, both context and statistical methods seem to matter. Most researchers have used conventional covariate adjustment – controlling for a range of characteristics of

children and their families – in regression models to estimate the consequences of ECEC. A number of Canadian studies using this method, for example, addressed utilization of non-parental care (center care or home day-care) during infancy and toddlerhood (rather than quantity thereof) and found lower rates of problem behavior in children from disadvantaged families attending non-parental care compared to those in parental care (e.g., Cote, Borge, Geoffroy, & Rutter, 2008; Cote et al., 2007). In the U.S., Loeb et al. (Loeb, Fuller, Kagan, & Carrol, 2004) found no associations between child care utilization and behavior problems in young children (1 to 4 years old) from poor families, while providing analyses suggesting that selection into center care was not strongly biasing their results.

Employing rigorous techniques like instrumental variables and fixed-effects, earlier child care and pre-k utilization in the U.S. was associated with higher levels of behavior problems at the start of kindergarten across income strata (Loeb, Bridges, Bassok, Fuller, & Rumberger, 2007; Magnuson et al., 2007). In contrast, while Crosby et al. (Crosby, Dowsett, Gennetian, & Huston, 2010) found preschool attendance for disadvantaged children to be associated with more externalizing behavior when using conventional regression analyses, using instrumental variable analyses to draw causal inferences, their finding was the opposite: preschool attendance was associated with fewer externalizing problems.

Quality of care likely also plays a role in determining whether ECEC offers protection from disadvantaged and stressful home contexts. The extent to which time outside of a stressful home environment provides protection from that stress likely depends on the extent to which the ECEC context is orderly, calm, sensitive, and responsive rather than chaotic, insensitive, and unresponsive (e.g., Votruba-Drzal et al., 2004). Indeed, higher quality care has been associated with better socio-emotional development in children from low-income families across early and middle childhood (Loeb et al., 2004; Votruba-Drzal, Coley, Maldonado-Carreno, Li-Grining, & Chase-Lansdale, 2010; Votruba-Drzal et al., 2004; Watamura, Phillips, Morrissey, McCartney, & Bub, 2011). Specifically, Loeb et al. (2004) found children from low-income families to have lower levels of behavior problems when having more sensitive and more educated caregivers. We suspect that higher-quality ECEC might also buffer them from the harm of income losses.

Family Income and ECEC in Norway

As one of the world's wealthiest nations, Norway has a *relatively* narrow gap between its richest and poorest citizens, with a GINI-index score of 0.25 (a score ranging from no inequality [0] to absolute inequality [1]), compared to an average of 0.32 in the OECD and 0.38 in the U.S. (OECD, 2011). This is in part a function of both a progressive tax system and a progressive social welfare system, where economically disadvantaged families are allowed both housing subsidies and means-tested temporary social benefits. As is the case with all wealthy nations, however, the distribution of income in Norway is highly skewed (e.g., the top 10% of the richest households account for over 50% of Norway's wealth and the top 1% of households account for more than 20% of the nation's wealth; Epland & Kirkeberg, 2012), albeit much less so than in the United States, for example. Moreover, while child poverty rates are much lower than in the United States (i.e., presently 6.1% of children, according to the OECD definition of 50% of the national median income, adjusted

for family size, compared to an average of 15% in the OECD), there is a clear socioeconomic gradient in child mental health which is comparable to those found in other countries (UNICEF Innocenti Research Center, 2012). There are, for instance, considerably higher levels of emotional and behavioral problems among school-age children in low-income families compared to their more affluent peers (Boe, Overland, Lundervold, & Hysing, 2012). Yet, in addition to universally-provided free health care and education (from age 6 through college), Norway is considered to have one of the most comprehensive sets of early childhood policies (UNICEF Innocenti Research Center, 2008).

With an aim of reducing social inequalities, a central component of early childhood policy in Norway is universally accessible, regulated, and subsidized ECEC in child care centers from age one, with the right to one year paid parental leave from birth to age one (Ministry of Education, 2010). Mandatory quality standards include teacher:child ratios of 1:10 for children younger than 3 years, 1:19 for older children, and a national curriculum (Ministry of Education, 2010). In addition, an adult:child ratio of 3:10 for children younger than 3 years and 3:19 for older children is recommended but not enforced by law. Standards of teacher requirement and adult:child ratio are currently not entirely met in all centers (UNICEF Innocenti Research Center, 2008), but evidence suggests that quality is relatively high and homogenous (Winsvold & Guldbrandsen, 2009). In the U.S., compliance with regulation standards in child care centers are associated with better cognitive and behavioral child outcomes in 2- and 3-year olds (NICHD Early Child Care Research Network, 1999).

As of 2009, 79% of all 1–2 year olds, and 97% of all 3–5 year olds attended center care. In part, these high rates of use are a function of affordability; center care in Norway is subsidized, with a maximum fee of NOK 2000 (app. USD 333/month) to be paid by the wealthiest parents. Yet, despite subsidies, there is social selection into center care, with low-income families, for example, less likely than others to choose regulated care center-based care for their young children (Zachrisson, Janson, & Nærde, 2013).

As an alternative to center-based care, family daycare is also regulated, although standards differ compared with centers. In family daycare, child group sizes are limited to 10, and adult:child ratios cannot exceed 1:5. There are no requirements of teacher training in family daycare, but caregivers must receive weekly supervision from a child care teacher. In addition, some children are cared for in unregulated settings by unqualified child minders (nannies) or in outdoor nurseries (i.e., playgrounds where the children are monitored by a few adults without formal qualifications in ECEC).

It is within this macroeconomic and early childhood policy context that we were interested in studying links between family income dynamics and children's social-emotional well-being as well as the moderating role of ECEC use. Most work on family income and child care as developmental contexts with consequences for social-emotional growth comes from the U.S. Yet, Norway provides an interesting comparison given its relative economic parity and universal access to regulated child care. Even in the progressive policy context of Norway, children from low income families display more problems, and attend center care less than other children. Yet, little is known about how income fluctuations, especially within low-income families, are associated with changes in young children's behavior

problems in a sociopolitical context of comprehensive social welfare, like Norway. Furthermore, while high quality ECEC, especially in preschool age, has repeatedly been found to protect children from low-income families against higher levels of behavior problems, little is known about the potential for ECEC to buffer the consequences of income fluctuations.

The Present Study

Our aim was to answer two research questions: Are income fluctuations, especially within low-income families, associated with changes in young children's behavior problems in Norway? Are the potentially ill effects of losses in family income buffered by utilization of regulated quality ECEC? Our expectation was that changes in income would be associated with changes in behavior problems (i.e., gains would predict improvements and losses would predict worsening problems), with effect sizes largest for the poorest children. In addition, we expected effect sizes to be smaller for children in center-based care than children who were not, because we expected the harm of income losses to be muted by center care (as well as the benefits of income gains to be muted because low-income children in center care were expected to be behaving relatively well even when income was relatively low). Answers to these questions would extend the cumulative knowledge because of the unique socio-political context of Norway and because the behavioral consequences of income fluctuations have been studied primarily in older children (i.e. preschool age and beyond), with less known about the role of income dynamics during early childhood.

Method

Participants

Data from the population-based Norwegian Mother and Child Cohort Study (MoBa; for a complete description, see Magnus et al., 2006, and www.fhi.no/morogbarn) were used in the present study. Information on health, lifestyle, and child development was collected by questionnaire during pregnancy at the 17th, 22nd and 30th weeks of gestation and after birth by mail when the child was six, 18 and 36 months of age. As of October 2010, 90,725 mothers of 108,639 children had enrolled and completed baseline assessments, which represented 42.1 % of all eligible mothers in Norway. Of the eligible children whose mothers enrolled, 69.3% ($n = 75,296$) were born by October 2007, making them eligible for inclusion in the present analyses because they were old enough for mothers to complete the 6-, 18-, and 36-month questionnaires. Among these children eligible for analyses, maternal questionnaire response rates at 18 and 36 months (the ages child behavior problems were assessed) were 72.4% and 59.3%, respectively.

Potential self-selection bias in the MoBa was examined by means of differences in prevalence estimates and association measures between MoBa participants and all women giving birth in Norway on demographics, health-related behaviors, and on a number of pregnancy- and birth-related variables (Nilsen et al., 2009). MoBa participants were on average older, and more likely to be cohabiting, and had fewer health related risks, and their children had better neonatal health than children of those not participating. However, the relative differences were small (0.3–1.2%).

Measures

Behavior problems—These were measured at 18 and 36 months by using selected items (7 items measured at 18 and 36 months were used for externalizing problems, 5 items for internalizing problems) from the mother reported *Child Behavior Checklist for ages 2–3* (CBCL/2–3; Achenbach, 1992). Items were selected by a team of four clinical and developmental psychologists, based on clinical and theoretical standards, as well as empirical representativeness (high factor loadings) for behavior problems. Mothers rated whether each item statement reflected their child's behavior during the last two months from "0 – not true" to "2 – very true or often true".

Items measuring externalizing problems were: "Can't concentrate, can't pay attention for long", "Quickly shifts from one activity to another", "Can't sit still, restless or hyperactive", "Gets into many fights", "Hits others", "Defiant", "Punishment doesn't change his/her behavior". Due to few items, scale reliability was moderate on both time points (Cronbach's $\alpha = .59$ at 18 months and $.67$ at 36 months). However, confirmatory factor analyses indicating adequate fit at 18 months (CFI/TLI = $.956/.907$, RMSEA = $.06$, allowing residuals for hyper-activity items to correlate as these are from a different CBCL subscale than the other items), and 36 months (CFI/TLI = $.959/.928$, RMSEA = $.07$, allowing residuals for hyper-activity items to correlate as these are drawn from a separate CBCL subscale than the other items), however without strong evidence for strict measurement invariance over time (CFI/TLI = $.803/.755$, RMSEA = $.08$). Items measuring internalizing problems were: "Clings to adults or too dependent", "Gets too upset when separated from parents", "Doesn't eat well", "Disturbed by any changes in routine", "Too fearful or anxious". Again, scale reliability was low due to few items (Cronbach's $\alpha = .40$ at 18 months and $.50$ at 36 months), but confirmatory factor analyses indicated good fit at 18 months (CFI/TLI = $.978/.955$, RMSEA = $.01$, no correlated residuals), and 36 months (CFI/TLI = $.978/.955$, RMSEA = $.03$, no correlated residuals), and with some evidence for strict measurement invariance over time (CFI/TLI = $.897/.878$, RMSEA = $.04$). In order to test the representativeness of the items selected for the MoBa questionnaire, we used the NICHD SECCYD to check for correlations between the scales computed by the selected items and the full scales of externalizing and internalizing in CBCL (we used data from 24 months in NICHD SECCYD to check the item selection at 18 months in MoBa). Correlations for externalizing were $.86$ and $.87$ at 18 and 36 months, respectively, and for internalizing $.70$ and $.65$ ($.71$ and $.70$ with the anxiety/depression scale) at 18 and 36 months, respectively. In accordance with recommendations by Achenbach (1992) for when a selection of items from the CBCL (rather than the complete scale) is used, we report raw scores rather than *T* scores. We use mean scores in our analyses.

Household income-to-needs—For household income, we had access to annual tax records for each participating mother, and from fathers who had agreed to participate in the MoBa (77.6%). In cases where father's income was missing, this was imputed by Expectation Maximization algorithm, including extensive information from the tax records on mother's income, fortune and depth dating back to 1993, as well as all available demographic information including self-reported total family income during pregnancy. We calculated a ratio of family income-to-needs by dividing total annual income by the OECD

poverty line for each particular year (50% of the median income, adjusted for family size; OECD, 2011c). A family with an income-to-needs ratio of 1 indicates that the family income corresponds to the poverty line for that particular family composition, a lower ratio indicates income below the poverty line, a higher ratio income above the poverty line. An example of income-to-needs with corresponding annual income for a family of 4 is displayed below in Fig 1. Income-to-needs was calculated for each family when the focal child was 18 and 36 months old.

ECEC arrangements—At 18 and 36 months, mothers reported type of child care arrangement that represented the child's primary care arrangement. At 18 months, this included "at home with mother or father", "at home with unqualified child minder", "unqualified child minder or family day care", and "center care". At 36 months, this included "at home with mother or father", "at home with unqualified child minder", "unqualified child minder or family day care", "outdoor nursery" and "center care". At both time points, we computed two dummy variables: (1) "home care" (i.e., equals 1, if cared for by mother or father) and (2) "family/unqualified care" (i.e., equals 1, if child was in any form of non-parental care that was not regulated to include educational content such as family day care, unqualified child minder, and outdoor nursery). Thus, the excluded (reference) group in our statistical models was children in center care.

Time-Varying Family covariates—Maternal and paternal education, partner status (single vs. partnered), were reported by the mothers at 17th gestational week. Mother's employment was coded as "employed" (1) if they reported to work more than 9 hours per week. Single parenthood was coded (1) if mothers reported not living with a partner. These covariates were reported by the mother when the child was 18 and 36 months old.

Time Invariant Background variables—Non-Norwegian family background was reported by the mothers at 17th gestational week. Child gender, birth weight (below 2500g was coded [1]), and malformations at birth (congenital syndromes including Down syndrome, cleft lip and palate, and limb malformations) was retrieved from the Medical Birth Registry.

Statistical Analyses

Fixed-effects analyses—We used fixed-effects models to estimate the association between changes in family income-to-needs and changes in child behavior problems from 18 to 36 months of age. By isolating within-family variation, one advantage of fixed-effects estimation is that unobserved between-family heterogeneity is effectively controlled, ruling out potential bias caused by unmeasured child, family, and context characteristics that are constant over time (Allison, 2009). The fixed-effects equation can be written as $y_{it} - \bar{y}_i = \beta_x(x_{it} - \bar{x}_i)$, or in the case of two observations per child as $y_{i1} - y_{i2} = \beta_x(x_{i1} - x_{i2})$. In our models (ignoring covariates and error term), y_{i1} and y_{i2} were behavior problem levels and x_{i1} and x_{i2} were income-to-needs at 18 and 36 months, respectively, for child i . As such, β_x is interpreted as the average within-person association between family income-to-needs-ratio and behavior problems.

The fixed-effects model can then be expanded to include time-varying covariates as well as interactions between two or more time-varying covariates. In the present study, we estimated interactions between family income-to-needs and child care; specifically, the interaction terms estimated the differences in the association between changes in income-to-needs and changes in child behavior problems as a function of attending different types of child care (either at 18 months, at 36 months, or both, i.e., exposure to a certain type of child care). Because the excluded child care arrangement was center-based care, the main effect of income-to-needs in our models is the association between within-family changes in income-to-needs and within-family changes in child behavior when children were in center care. The interaction terms indicated the degree of difference – for the main effect of within-family changes in income-to-needs – between the center care group and the home care and family/unqualified care groups, respectively.

Note that although fixed effects estimates, by design, control for all possible time-invariant sources of bias, unmeasured time-varying factors may still bias estimates, and estimate precision is limited to the extent that outcome measures are highly correlated over time (McCartney et al., 2006). For these reasons, we estimated models with and without time-varying covariates, recognizing that it is unknown whether all relevant covariates have been included. We calculated effect sizes in standard deviation units, dividing the unstandardized fixed-effects coefficients by the average between-child *SD* for externalizing and internalizing problems, respectively.

Non-linear estimates—In our statistical models, we estimated associations for both (a) income-to-needs levels (i.e., “linear” estimates) and (b) the log of income-to-needs levels (i.e., “semilog” estimates). The linear estimates assumed a constant strength of association between income-to-needs and behavior problems across all levels of the income-to-needs distribution; specifically, the linear coefficients indicated the change in behavior problems given a 1-point change in income-to-needs, regardless of whether that change occurred at a low (e.g., 1.00 to 2.00) or high (e.g., 3.00 to 4.00) point of the income-to-needs distribution.

The semilog estimates, on the other hand, assumed non-linearity with larger effect sizes at lower levels of income-to-needs and decreasingly smaller effect sizes at higher levels of income-to-needs; specifically, the semilog coefficients indicated the change in behavior problems given a change in income-to-needs from 1.00 to 2.00 (for families with higher or lower income-to-needs than 1.00, the coefficient must be divided by families’ initial level of income-to-needs to calculate the estimated change in behavior problems). Comparing these two estimators allowed us to determine whether income had non-linear associations with child behavior problems, as has been detected in previous work (e.g., Dearing & Taylor, 2007; Votruba-Drzal et al., 2004). Specifically, non-linearity would be indicated if semilog estimates were larger and/or more precise than linear estimates.

Missing data—The percentage of missing data due to item non-response was less than two percent across all items, with only one exception: externalizing behavior items at 18 months (6.5%). We replaced missing items in scales with the scale mean. Missing data due to attrition, however, was more considerable, with 72.4% response rate at 18 months and 59.3% at 36 months. Following best practice recommendations for handling moderate to

large amounts of missing data, we used multiple imputation (MI; Graham, 2009). We estimated 20 datasets based on all covariates in Table 1, using Stata 12 (StataCorp LP, 2013), with fully conditional specification of the multivariate model by a series of conditional linear models, one for each incomplete variable. We estimated all models for participants with complete data (using listwise deletion for all other participants) and with the MI data. Results were substantively identical, and we therefore report results from the MI analyses only.

Results

Descriptive Statistics

As preliminary step in our analytic plan, we examined the level of variability, across time, in for income-to-needs and behavior problems. Means and standard deviations for all time-variant covariates, as well as time-invariant background variables for descriptive purposes, are in Table 1. Relative to the between-family variation, there was considerable within-family variation. For both externalizing and internalizing problems, for example, the average within-child *SDs* across time were 0.23 and 0.21, about 75% of the between-child *SDs*. For income-to-needs, the average within-family *SD* was .50, approximately 54% of the between-family *SD*. Two percent of the sample was below the poverty line at 18 months, with 13% being below 1.5 times the poverty line at this point. At 36 months, corresponding numbers were 2.4% and 14.8%. Decreases in income-to-needs across the two time points were evident for 51.7 percent of the sample, with an average decrease of 0.33 times income-to-needs (standard deviation 0.65), while 48.2 percent had an increase, with an average of 0.29 times income-to-needs (standard deviation 0.57). Only 0.12% had no change in income-to-needs. The majority of change in care from 18 to 36 months was into center care, 20.2% of the sample changed from home care and 21.4% from family/unqualified care. In contrast, less than a percent changed from center care to home care or family/unqualified care, while 2.1% changed from home care to family/unqualified care and less than a percent moved from family/unqualified care to home care.

Associations between Family Income-to-Needs and Behavior Problems

The first aim in our inferential analyses was to determine the average strength and form of associations between changes in family income-to-needs and changes in child behavior problems in the sample. To begin, we examined unconditional associations between family income-to-needs (linear and semilog) and child behavior problems (see upper rows of Table 2). Across these unconditional models, changes in income-to-needs predicted, negatively, changes in both externalizing and internalizing problems, meaning that increases in income-to-needs were associated with decreases in behavior problems and vice versa. Although effects sizes were small in absolute terms, there was consistent evidence of non-linearity: the largest coefficients, by a sizable margin, corresponded to the semilog estimates, although these were less precise than the linear estimates. For families who gained enough income to move from the poverty line up to 200% of the poverty line (i.e., a 1-point increase in family income-to-needs, which equates to about 90% of the between-family *SD*) in the unconditional models predicted approximately 12% of a *SD* decrease in externalizing problems and approximately 14% of a *SD* decrease in internalizing problems.

As a next step, we conditioned these associations on a set of time-varying covariates (see lower section of Table 2). After adjusting for within-family changes in partner status, maternal employment, and child care arrangement, increases in income-to-needs were significantly associated with decreases in externalizing problems, and the association remained more pronounced at the low end of the income-to-needs distribution. For internalizing problems, the linear estimate was not quite statistically significant ($p=.075$) once conditioned on covariates, but the semilog estimate remained significant, also indicating a more pronounced association at the lower end of the income spectrum.

Figure 1 shows the predicted *changes* in SD units for externalizing and internalizing problems given a 1-unit increase in family income-to-needs, based on the semilog models (the income-to-needs distribution in the figure ranges from approximately 2 SD below and above the mean income-to-needs, covering 97% of the sample). For example, in Figure 1, it is evident that moving from the poverty line to 200% of the poverty line (i.e., increased income-to-needs from 1 to 2) predicted a reduction in externalizing problems equivalent to 11% of a SD, and in internalizing problems equivalent to 10% of a SD. These effect sizes represent the main effects from the conditional semi-log models displayed in Table 2. As the initial income-to-needs are higher, changes in income-to-needs are associated with increasingly smaller changes in behavior problems. For middle class or wealthier families (e.g., income-to-needs above 2.5) increases in income-to-needs predicted negligible changes in child behavior (i.e., a 1-point increase in income-to-needs predicted about 4% of a SD change in problem scores or less).

To determine whether these associations differed depending on whether families had gained or lost income, we added an interaction term (for both outcomes and for both income specifications) that allowed the within-family estimates for income-to-needs to vary for families whose income increased versus decreased. None of these were interaction terms were statistically significant; the estimated effect of change in income-to-needs was similar for families who experienced gains and those who experienced losses.

Although modest even at the low end of the distribution, these effect sizes for income-to-needs were similar to the effect sizes for changes in partner status, and twice as large as the effect sizes for maternal employment changes. Beyond income-to-needs, it is notable that changes in maternal employment were negatively associated with changes in both externalizing and internalizing problems such that problems were reduced when mothers entered work. Furthermore, changes in family structure from one-parent to two-parent status also predicted decreases in internalizing problems. Finally, changes in home care, which were mainly changes into center care, were associated with decreases in internalizing, but not externalizing problems. In contrast, changes in family/unqualified care, again mainly into center care, was associated with increases in internalizing but not externalizing problems. However, these main effects assume that the associations are constant across the income spectrum, an assumption we further address in our second research question.

Does Type of Care Moderate Links between Income-to-needs and Child Behavior?

To follow up on the evident main effect associations, our second primary aim was to determine whether variations in children's child care arrangements might alter the strength

of association between income-to-needs and child behavior problems. Specifically, we tested the hypothesis that associations between income-to-needs and behavior would be weakest when children were in center-based care compared with other arrangements (i.e., home care and family/unqualified care). Results for these moderator analyses can be seen in Table 3; note that the models presented are identical to the conditional models in Table 2, with the addition of interaction terms for income-to-needs by type of care. For interpretative purposes, also note that the main effect coefficients for income-to-needs in these models correspond to the estimated effect of income-to-needs for children who were in center care (to determine main effect estimates for children in the two other types of care, their interaction coefficient must be added to the income-to-needs coefficient).

For externalizing problems, there was no evidence that children's child care arrangement moderated the association with income-to-needs. For internalizing problems, however, the interaction terms were statistically significant such that the estimated effects of change in income-to-needs was greater for children who were in home care and in family/unqualified care. And, given larger main effect and interaction coefficients for the semilog compared with linear estimators, the practical significance of the moderation effects appeared greatest at the low end of the income-to-needs distribution.

In Figure 2, we have plotted these non-linear interactions, presenting predicted levels of internalizing problems across the income-to-needs distribution for children in different types of care (Figure 2a), as well as the predicted change in internalizing problems, in SD units, for children in different types of care (Figure 2b). In Figure 2a, first note that across much of the income-to-needs distribution, center care appeared protective relative to home and family/unqualified care. At levels of family income-to-needs of 3.42 and lower, regions of significance (vertical lines with arrows in Figure 2a) indicated that children had significantly fewer reported internalizing problems when in center care than when in home care; this was also true at levels of income-to-needs of 2.02 and lower for center care versus family/unqualified care. Unexpectedly, at high levels of income-to-needs (at or above 3.23), children had significantly lower internalizing problems when in family/unqualified care than when in center care. Note, however, that this upper region includes a much smaller proportion of the sample compared to the lower regions (i.e., approximately 50% of families had income-to-needs at or below 2.02 at one or more observations compared with 7% at or above 3.23).

Also note (see Figure 2b and Table 3) that changes in income-to-needs were not significantly related to changes in internalizing problems when children were in center care (i.e., when in center care, children's internalizing problems remained at stable low levels, regardless of families' income-to-needs). On the other hand, for both children in home care and family/unqualified care, associations between changes in income-to-needs and changes in internalizing problems were significant ($p < .001$) and relatively large, particularly at the low end of the income distribution. When income-to-needs increased by 1 point, problems for children in the poorest families decreased by about 40% of a standard deviation, and this was evident for children both in home care and in family/unqualified care. It is also notable that although children in family/unqualified care had lower levels of internalizing problems

compared to children in home care (see Figure 2a), their rate of change in internalizing problems in response to changes in income-to-needs was nearly identical (see Figure 2b).

Importantly, these interactions and corresponding regions of significance are best interpreted with attention to the main effects of center care versus other arrangements and variations in these main effects across the income distribution. Specifically, in addition to the fact that moving into center based care was, on average, associated decreases in internalizing problems (see Table 2), the significant interactions of care arrangement by income-to-needs is also correctly interpreted as indicating that moving into center-based care predicted the largest decreases in internalizing problems for the poorest children. Thus, internalizing problem levels were lowest for low-income children when they were in center-based care, and their low problem levels were neither increased nor decreased by fluctuations in income when in center care.

Discussion

In a large, population-based sample of Norwegian children, we examined the implications of family income dynamics and ECEC use for externalizing and internalizing problems during early childhood. Compared with other wealthy nations, progressive social policy in Norway has generated relatively low levels of income inequality and high levels of state-subsidized and regulated ECEC use among low-income infants and toddlers. Within this context, we were interested in whether changes in economic well-being would predict changes in early child problem behavior within families, as has been observed in U.S., though primarily in older children. We were also interested in whether regulated quality ECEC might alter the associations between household economics and child behavior problems, perhaps lessening the developmental consequences of income fluctuations for low-income children.

Our first main finding was that *within-family changes in economic well-being* predicted within-child changes in both externalizing and internalizing problems, which is broadly consistent with studies of U.S. samples (e.g., Costello et al., 2003; D'Onofrio et al., 2009; Dearing et al., 2006; Votruba-Drzal, 2006); increases in income-to-needs predicted decreases in behavior problems, even once controlling for within-family changes in partner status, employment, and ECEC use. These associations were most pronounced among lower-income families, albeit modest in size, on average. Moving from the poverty threshold up to 200% of the poverty threshold predicted approximately 10% of a standard deviation change in problem behaviors, on average. For middle-class and wealthier families the estimated effects of changes in income-to-needs were negligible.

These findings for dynamics in economic well-being must be considered in light of our findings for center-based child care, however, at least with regard to internalizing problems. Within-child changes in child care arrangements were predictive of within-child changes in internalizing problems such that moving into center-based care from home-based care or from family/unregulated care was associated with declines in children's levels of internalizing problems. Moreover, being in center-based care appeared to buffer children from the consequences of change in family income. Child care arrangements moderated the within-family associations between changes in income-to-needs and changes in internalizing

problems such that when in center-based care there was no association between income-to-need change and internalizing problem change for low- or high-income children. On the other hand, changes in income had relatively large associations with internalizing problems for lower-income children; dropping from 150% of the poverty threshold down to 50% of the poverty threshold was associated with a 40% standard deviation increase in internalizing problems for children in home care, family day care, or other forms of unregulated care.

The Main Effects of Changes in Income-to-Needs for Young Children in Norway

It is notable that our main effect findings for changes in family income-to-needs in Norway replicate similar evidence in the United States, despite very different socio-political and macroeconomic contexts. Indeed, for externalizing problems, our average effect sizes for the poorest children in Norway were very similar to those reported for older children in the United States and our effect sizes were *larger* than those reported in the US for internalizing problems (e.g., Dearing et al., 2006, report that \$10,000 dollar increases in income predicted 15% of a standard deviation decrease in externalizing problems for chronically poor children and negligible changes in internalizing problems for these children).

On the surface, these findings may seem somewhat surprising. Compared with the US, Norway has lower levels of income inequality and a relative abundance of child and family policy supports; beyond universal access to quality-regulated ECEC beginning at age 1, Norway has, for instance, universal state-subsidized health care, state-subsidized higher education, extensive paid parental leave, shorter work hours, and extended vacation time. One might expect that economic parity and a broad array of family supports largely alleviate the mental health consequences of living at relatively lower versus higher economic levels, by minimizing stressors associated with poverty. Nonetheless, family stress may still follow economic *loss* in Norway, ultimately resulting in child dysregulation (e.g., Elder, Nguyen, & Caspi, 1985), even in the context of economic parity and public supports. In short, it is likely unrealistic to expect that social supports in Norway are efficient and timely enough to fully buffer families and children from the acute stress responses that follow income shocks. In addition, some stress-reduction benefits of economic gains for lower-income families, even if only short-lived, may be evident even when absolute economic standing is of less importance than in nations with greater disparity.

At a more specific level, some of our findings diverge from some previous studies (e.g., Costello et al., 2003; Dearing et al., 2006) who found externalizing problems to be more strongly associated with income changes than internalizing problems. However, in contrast to the present study relying on maternal reports, Dearing et al. (2006) relied on reports by teachers and included older children. Detecting internalizing symptoms may be more difficult in contexts outside of the family, and especially so in older children. Alternatively, the differences between our findings and those in previous studies may relate to the fact that we address younger children, and that responses to income fluctuations with changes in the internalizing domain may be greater at younger ages.

The Moderating Effects of Center-based Child Care

The second aim of our study was to investigate whether ECEC moderated associations between changes in income-to-needs and children's behavior problems, expecting that low-income children in center care may be protected from the harm of income losses (and less likely to need the stress-reducing benefits of income gains). Indeed, at least for internalizing problems, changes in family economic well-being appeared to have consequences only for low-income children who were not in center-based ECEC. The association between family economics and child internalizing problems for children not in center care was particularly strong for the poorest children. There was, however, one exception to this finding: at the higher end of the income distribution, children in family day care and other unregulated forms of non-parental care showed significantly less response to changes in income-to-needs than those in center-based care. Yet, the effects of economic changes were relatively small for all families at this end of the distribution (e.g., less than 10% of standard deviation decrease in internalizing problems associated with moving from 350% of the poverty threshold to 450% for children in center-based care).

Our findings are, in general, in accordance with the notion that for children from low income families, high-quality center care represents a protective environment in which the negative effects of social disadvantage seem less influential (Cote et al., 2008; Crosby et al., 2010). This contrasts with quasi-experimental findings from the U.S. (Loeb et al., 2007), although notably children in some of these studies attend pre-school at older ages than the children in the present study (Crosby et al., 2010; Loeb et al., 2007). The present finding must be considered in light of the Norwegian context, where children rarely enters non-parental care prior to the end of the first year due to parental leave policies. Thus, the potentially negative consequences of very early entry, which is common in the U.S., may therefore be avoided (Zachrisson, Dearing, et al., 2013). Furthermore, although data on child care quality is not available in MoBa, quality regulations regarding adult:child ratios, teacher education, and physical environment in centers ensures high levels of structural quality, and national reports suggest that this is quite homogenous across centers (e.g., Winsvold & Guldbrandsen, 2009). In addition, center care is nearly universally accessible, subsidized, and therefore available even to children from low income families. In sum, Norwegian child care centers may therefore provide an available and affordable developmental context, and our findings suggest that something with this context protect children against negative effects of income fluctuations.

It is notable that our findings regarding family/unqualified care indicate that it is not the alternative context to the home environment per se which protects low income children. Unfortunately, the design of the MoBa questionnaire hampers a comparison between home-care, center care, and family day care, as the latter was lumped together with unqualified child minder in the questionnaires. Family day care consists of small groups of children and low adult:child ratios, yet with a caregiver without a degree in early childhood education. In contrast, outdoor nurseries and unqualified child minders are not regulated; group sizes, adult:child ratios, teacher education and other structural qualities are therefore unknown. The fact that we find little protective effect of family/unqualified care at the lower end of the income spectrum, but highly protective effect at the higher end, compared to children in

center care, may speak to selection effects not accounted for by the fixed-effects modelling. If children in the lower end of the income spectrum attend poor quality outdoor nurseries or unqualified child minders, while those in the high end attend carefully selected family day care, the buffering effects would potentially be very different. Ideally therefore, family day care should have been included as a separate category or included in the center care group. However, we do not think these constraints of our data compromise the main finding of our paper, as our main focus is on the buffering effect of ECEC for low income children, and for this group, the buffering effect of center care compared to any other type of care is indisputable.

In contrast to some previous studies, we do not find the interaction between family income-to-needs and ECEC attendance to be associated with externalizing problems but with internalizing problems. This finding was unexpected, and therefore, warrants a careful consideration of both methodological and substantive level. Regarding methodology, our measure of externalizing problems seems psychometrically robust, despite being a selection of items. It is also associated in predictable ways to changes in income-to-needs and maternal employment, and has approximately the same within-child variability as internalizing problems. Thus, we consider this a substantive finding rather than an artefact of the measure.

A few other child care studies have included internalizing problems as child outcomes (e.g., Cote et al., 2008; Lekhal, 2012; Votruba-Drzal et al., 2004). Lekhal (2012) found no main effect of type of child care on internalizing problems in 3 year olds in Norway, while Coté et al. (2008), in a Canadian sample, found use of non-maternal care in the first year to be associated with lower levels of emotional problems among 4-year olds, but only among girls in families at high social risk. None of these findings are directly comparable to ours. In contrast, while considering quality and quantity of non-maternal care, Votruba-Drzal et al. (2004) found that low-income children aged 2–4 years in the US had lower levels of internalizing problems when attending higher quantities of high-quality care. This is by and large consistent with our findings, lending further support to the potentially protective role of high quality care for internalizing problems in children from low income families, and suggesting that internalizing problems may be an equally important outcome as externalizing problems in studies of ECEC in low income children.

We suggest three potential explanations for the buffering effect of center care on internalizing but not externalizing problems. As mentioned, the explanation is not likely to be simply the alternative context to the home environment, as the finding does not apply to family/unqualified care for low income children. Rather, the finding may be explained by advantages of teacher training. In Norwegian child care centers, there are teachers with a three year tertiary degree in early childhood education. Developmental psychology is part of the training for these teachers. It may therefore be that the teachers are more qualified to recognize symptoms of internalizing problems, and consequently provide the nurturing and care these children need. In contrast, symptoms of externalizing problems are more easily detected, and may therefore receive attention regardless of the care givers' training. A second and related explanation may be that although our abbreviated measure correlated highly with the overall measure, the behaviors emphasized in the abbreviated scale (e.g., 3

of the 7 items were focused on inattention and hyperactivity) may be driving these results more strongly than analyses using the full scale. Restlessness and inattention may be more normative at this early age, and less susceptible to the buffering effect of ECEC. Alternatively, when this external dysregulation of behavior is response to unexpected, acute changes in the home environment (e.g., changes in family routines and housing), they may be more pervasive than internalizing problems, and therefore less malleable to the type of nurturing and care provided in center care. Yet, the finding remains unexplained and warrant further attention.

We interpret our findings with the limitations and strengths of the present study in mind. Despite a large sample, the baseline participation rate of approximately 40% leaves considerable risk for selection bias into the study. This is underscored by previous investigations finding, on average, older mothers with lower health risks and children with better neonatal health to be more likely to participate in the study (Nilsen et al., 2009). Furthermore, there is considerable attrition in the sample, with more than 40% dropping out by the child age of 3 years, a challenge endemic to large population based studies (Szklo, 1998). Multiple imputation, as used in the present study, is best practice when attrition is moderate to large (Graham, 2009). It is also worth noting that although our income measure is strong relative to most work in this area which relies on family self-report, we did not have data on child care quality. A more nuanced estimate of ECEC as a protective environment may have been possible if quality data were available (Votruba-Drzal et al., 2010). Furthermore, as discussed above, implications of our findings regarding family/unqualified care is hampered by the precision in the MoBa questionnaire; we do not know whether this group attended family day care, or were cared for by unqualified child minders. Finally, despite the strengths of a fixed-effects approach, our analyses of interactions between child care type and income-to-needs do not specify the age at which children are in the specific types of care. Thus, we are not able to address whether specific timing of exposure to center care buffers the associations between changes in income and changes in behavior, just whether such buffering occurs. However, issues about timing of center care as protective factor is an interesting topic to be addressed in future inquiries.

We draw two main policy implications from our findings, relating specifically to Norway, but potentially relevant in other sociopolitical contexts as well. First, despite comprehensive support for low-income families in Norway, greater efficiency and timeliness in this support may help disrupt the seemingly fast acting harms of income loss. Second, despite universally accessible and subsidized ECEC, there is a social gradient in utilization, with lowest levels of utilization for low income children who would benefit the most from ECEC. Stronger efforts to promote ECEC for low-income children, (e.g., stronger economic incentives) appear justified for realizing universal access and for promoting the well-being of these children (Zachrisson, Janson, et al., 2013).

Conclusions

In the context of a Norway, with its national wealth, low income inequality, and social support for low-income families, children in low-income families still appear to be sensitive to income dynamics, i.e., within-family changes in income, a finding which is consistent

with U.S. studies. Moreover, children in regulated quality ECEC appear to be protected against the negative effects of within-family changes in income, but only with regard to internalizing problems.

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References

- Achenbach, TM. Manual for the Child Behavior Checklist / 2–3 and 1992 Profile. Burlington, VT: University of Vermont Department of Psychiatry; 1992.
- Allison, P. Fixed Effects Regression Models. Thousand Oaks: Sage Publications; 2009.
- Boe T, Overland S, Lundervold AJ, Hysing M. Socioeconomic status and children's mental health: results from the Bergen Child Study. *Social Psychiatry & Psychiatric Epidemiology*. 2012; 47:1557–1566. [PubMed: 22183690]
- Conger RD, Donnellan MB. An interactionist perspective on the socioeconomic context of human development. *Annual Review of Psychology*. 2007; 58:175–199.
- Costello EJ, Compton SN, Keeler G, Angold A. Relationships between poverty and psychopathology: a natural experiment. *JAMA*. 2003; 290:2023–2029. [PubMed: 14559956]
- Cote SM, Boivin M, Nagin DS, Japel C, Xu Q, Zoccolillo M, et al. The role of maternal education and nonmaternal care services in the prevention of children's physical aggression problems. *Archives of General Psychiatry*. 2007; 64:1305–1312. [PubMed: 17984399]
- Cote SM, Borge AI, Geoffroy MC, Rutter M. Nonmaternal care in infancy and emotional/behavioral difficulties at 4 years old: Moderation by family risk characteristics. *Developmental Psychology*. 2008; 44:155–168. [PubMed: 18194014]
- Crosby DA, Dowsett CJ, Gennetian LA, Huston AC. A tale of two methods: comparing regression and instrumental variables estimates of the effects of preschool child care type on the subsequent externalizing behavior of children in low-income families. *Developmental Psychology*. 2010; 46:1030–1048. [PubMed: 20822221]
- D'Onofrio BM, Goodnight JA, Van Hulle CA, Rodgers JL, Rathouz PJ, Waldman ID, et al. A quasi-experimental analysis of the association between family income and offspring conduct problems. *Journal of Abnormal Child Psychology*. 2009; 37:415–429. [PubMed: 19023655]
- Dearing, E. The state of research on children and families in poverty: Past, present, and future empirical avenues of promise. In: McCartney, K.; Yoshikawa, H.; Forcier, L., editors. *Improving the Odds for America's Children*. Cambridge, MA: Harvard Education Press; 2014.
- Dearing E, McCartney K, Taylor BA. Within-child associations between family income and externalizing and internalizing problems. *Developmental Psychology*. 2006; 42:237–252. [PubMed: 16569163]
- Dearing E, Taylor BA. Home improvements: Within-family associations between income and the quality of children's home environments. *Journal of Applied Developmental Psychology*. 2007; 28:427–444.
- Elder GH Jr, Nguyen TV, Caspi A. Linking family hardship to children's lives. *Child Development*. 1985; 56:361–375. [PubMed: 3987413]
- Epland, J.; Kirkeberg, MI. Wealth distribution in Norway. Evidence from a new register-based data source. Oslo, Norway: Statistics Norway; 2012. Report 35/2012.
- European Commission. Early Childhood Education and Care: Providing all our children with the best start for the world tomorrow. Brussels: European Commission; 2011. Retrieved June 28th 2013 from <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0066:FIN:EN:PDF>
- Evans GW. The environment of childhood poverty. *American Psychologist*. 2004; 59:77–92. [PubMed: 14992634]

- Gennetian LA, Castells N, Morris P. Meeting the Basic Needs of Children: Does Income Matter? *Children and Youth Service Review*. 2010; 32:1138–1148.
- Geoffroy MC, Cote SM, Giguere CE, Dionne G, Zelazo PD, Tremblay RE, et al. Closing the gap in academic readiness and achievement: the role of early childcare. *Journal of Child Psychology and Psychiatry*. 2010; 51:1359–1367. [PubMed: 20883519]
- Graham JW. Missing data analysis: Making it work in the real world. *Annual Review of Psychology*. 2009; 60:549–576.
- Lekhal R. Do type of childcare and age of entry predict behavior problems during early childhood? Results from a large Norwegian longitudinal study. *International Journal of Behavioral Development*. 2012; 36:197–204.
- Loeb S, Bridges M, Bassok D, Fuller B, Rumberger RW. How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review*. 2007; 26:52–66.
- Loeb S, Fuller B, Kagan SL, Carrol B. Child care in poor communities: Early learning effects of type, quality, and stability. *Child Development*. 2004; 75:47–65. [PubMed: 15015674]
- Magnus P, Irgens LM, Haug K, Nystad W, Skjaerven R, Stoltenberg C. Cohort profile: The Norwegian Mother and Child Cohort Study (MoBa). *International Journal of Epidemiology*. 2006; 35:1146–1150. [PubMed: 16926217]
- Magnuson KA, Ruhm C, Waldfogel J. Does prekindergarten improve school preparation and performance? *Economics of Education Review*. 2007; 26:33–51.
- McCartney K, Dearing E, Taylor B, Bub KL. Quality child care supports the achievement of low-income children: Direct and indirect pathways through caregiving and home environment. *Journal of Applied Developmental Psychology*. 2007; 28:411–426. [PubMed: 19578561]
- McCartney K, Bub KL, Burchinal M. Selection, reflection, detection. *Monographs of the Society for Research in Child Development*. 2006; 71:105–126.
- McCartney K, Burchinal M, Clarke-Stewart A, Bub KL, Owen MT, Belsky J. Testing a series of causal propositions relating time in child care to children's externalizing behavior. *Developmental Psychology*. 2010; 46:1–17. [PubMed: 20053002]
- Ministry of Education. Barnehaeloven [The Kindergarten Act]. 2010 Retrieved (2014 Mar 18) from <http://www.lovdato.no/all/nl20050617-064.html>.
- NICHD Early Child Care Research Network. Child outcomes when child care center classes meet recommended standards of quality. *American Journal of Public Health*. 1999; 89:1072–1077. [PubMed: 10394318]
- NICHD Early Child Care Research Network. Does amount of time spent in child care predict socioemotional adjustment during the transition to kindergarten? *Child Development*. 2003; 74:976–1005. [PubMed: 12938694]
- Nilsen RM, Vollset SE, Gjessing HK, Skjaerven R, Melve KK, Schreuder P, et al. Self-selection and bias in a large prospective pregnancy cohort in Norway. *Paediatric and Perinatal Epidemiology*. 2009; 23:597–608. [PubMed: 19840297]
- OECD. Divided we stand. Why inequality keeps rising Paris: OECD statistics. 2011 Retrieved June 28th 2013 from <http://www.oecd.org/els/soc/dividedwestandwhyinequalitykeepsrising.htm>.
- Solheim E, Wichstrom L, Belsky J, Berg-Nielsen TS. Do Time in Child Care and Peer Group Exposure Predict Poor Socioemotional Adjustment in Norway? *Child Development*. 2013; 84:1701–1715. [PubMed: 23461755]
- StataCorp LP. College Station, TX; 2013. Stata 12 [Computer software].
- Szklo M. Population-based cohort studies. *Epidemiological Review*. 1998; 20:81–90.
- UNICEF Innocenti Research Center. Report Card 8: The child care transition. Florence, Italy: UNICEF Innocenti Research Center; 2008.
- UNICEF Innocenti Research Center. Report card 10: Measuring child poverty. New league tables of child poverty in the world's richest countries. Florence, It: UNICEF Innocenti Research Center; 2012.
- Votruba-Drzal E. Economic disparities in middle childhood development: does income matter? *Developmental Psychology*. 2006; 42:1154–1167. [PubMed: 17087549]

- Votruba-Drzal E, Coley RL, Chase-Lansdale PL. Child care and low-income children's development: direct and moderated effects. *Child Development*. 2004; 75:296–312. [PubMed: 15015691]
- Votruba-Drzal E, Coley RL, Maldonado-Carreno C, Li-Grining CP, Chase-Lansdale PL. Child care and the development of behavior problems among economically disadvantaged children in middle childhood. *Child Development*. 2010; 81:1460–1474. [PubMed: 20840234]
- Watamura SE, Phillips DA, Morrissey TW, McCartney K, Bub KL. Double jeopardy: Poorer social-emotional outcomes for children in the NICHD SECCYD experiencing home and child-care environments that confer risk. *Child Development*. 2011; 82:48–65. [PubMed: 21291428]
- Winsvold, A.; Guldbrandsen, L. Kvalitet og kvantitet - kvalitet i en barnehagesektor i sterk vekst (Quality and quantity - Quality in a child-care sector in rapid growth). Oslo: NOVA; 2009.
- Yoshikawa H, Aber JL, Bergman LR, Beardslee WR. The Effects of Poverty on the Mental, Emotional, and Behavioral Health of Children and Youth. *American Psychologist*. 2012; 67:272–284. [PubMed: 22583341]
- Zachrisson HD, Dearing E, Lekhal R, Toppelberg CO. Little Evidence That Time in Child Care Causes Externalizing Problems During Early Childhood in Norway. *Child Development*. 2013; 84:1152–1170. [PubMed: 23311645]
- Zachrisson HD, Janson H, Nærde A. Predicting early center care utilization in the context of universal access. *Early Childhood Research Quarterly*. 2013; 28:74–82.

Figure 1. Nonlinear Within-Child Associations Between Behavior Problems and Family Income
 Estimated effect sizes (in SD units) for nonlinear within-child fixed-effects models for the conditional non-linear associations between changes behavior problems changes in family income. The horizontal lines on the Y-axis represent 5% of a between-child standard deviation across time. The values on the X-axis are income-to-needs ratios, with example of income for a family of two adults and two children in 2006 kroner value. The range of the Y-axis covers income-to-needs for 97% of the sample.

Figure 2. Nonlinear Within-Child Associations Between Internalizing Problems and Family Income Moderated by Type of Care

Figure 2a is the nonlinear within-child fixed-effects estimates for the conditional non-linear associations between *level* of internalizing problems and income-to-needs for children in Home Care (dashed line), Family/Unqualified Care, and Center Care (solid line). The horizontal lines on the Y-axis represent approximately 10% of a within-child standard deviation across time. The vertical lines in Figure 2a represent bounds of the regions of income-to-needs where Home Care and Family/Unqualified Care, is significantly different from Center Care (arrows pointing in the direction at which the regions are significant). Figure 2b is the estimated effect sizes (in SD units) given a 1-point increase in income-to-needs for children in different types of care.

Table 1

Descriptive Statistics

Variable	Mean/%	Std. Dev.	Min	Max
Behavior problems				
Externalizing 18 mo	1.50	0.30	0	2
Externalizing 36 mo	1.51	0.32	0	2
Internalizing 18 mo	1.27	0.26	0	2
Internalizing 36 mo	1.28	0.28	0	2
Income-to-needs and total income				
Income-to-needs 18 mo	2.24	0.91	0	10
Income-to-needs 36 mo	2.20	0.90	0	10
Total family income (NOK) 18 mo	583.663	203 419	0	1 500 000
Total family income (NOK) 36 mo	598.866	208 591	0	1 500 000
Child care				
Home care 18 mo (%)	27.2			
Home care 36 mo (%)	5.3			
Family/unqualified care 18 mo (%)	25.7			
Family/unqualified care 36 mo (%)	6.0			
Center care 18 mo (%)	47.1			
Center care 36 mo (%)	88.7			
Time-varying covariates				
Single parenthood 18 mo (%)	2.1			
Single parenthood 36 mo (%)	2.9			
Maternal employment 18 mo (%)	79.5			
Maternal employment 36 mo (%)	77.8			
Time-invariant background variables				
Non-Norwegian background (%)	10.3			
Paternal education (years)	14.02	2.76	8	18
Maternal education (years)	14.58	2.51	8	18
Malformation at birth (%)	5.0			
Boys (%)	51.1			
Birth weight < 2500 g	4.3			

Note: N=75,296

Table 2

Summary of Fixed-effects Models Predicting Externalizing and Internalizing Problems From Income-to-needs (ITN)

	<u>Externalizing</u>		<u>Internalizing</u>	
	<u>Linear ITN</u>	<u>Semilog ITN</u>	<u>Linear ITN</u>	<u>Semilog ITN</u>
Income-to-needs (ITN) uncond.	-.007(.003)* [.023]	-.038(.011)*** [.123]	-.007(.003)* [.026]	-.038(.012)** [.141]
	Linear ITN	Semilog ITN	Linear ITN	Semilog ITN
Income-to-needs (ITN) cond	-.006(.003)* [.019]	-.035(.011)** [.113]	-.005(.003) [.019]	-.027(.012)* [.100]
Time-varying covariates				
Single parenthood	.011(.011) [.035]	.007(.011) [.023]	.031(.010)** [.115]	.030(.010)** [.111]
Maternal employment	-.011(.003)*** [.003]	-.010(.003)*** [.032]	-.013(.003)*** [.048]	-.012(.003)*** [.044]
Home care	-.001(.004) [.13]	-.001(.004) [.003]	.016(.004)*** [.059]	.016(.003)*** [.059]
Family/unqualified care	.006(.004) [.019]	.007(.004) [.023]	-.011(.003)*** [.041]	-.011(.003)** [.041]

Note: (N=75,296)

Standardized coefficients are in brackets. MI models were based on 20 imputed datasets.

Time varying control variables are changes from 18 to 36 months in single parenthood, maternal employment, home care and family/unqualified care.

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$.

Table 3

Summary of Conditional Fixed-effects Models Predicting Externalizing and Internalizing Problems From Income-to-needs (ITN) Moderated by Home Care and Family/unqualified care.

	Externalizing		Internalizing	
	<u>Linear ITN</u>	<u>Semilog ITN</u>	<u>Linear ITN</u>	<u>Semilog ITN</u>
Income-to-needs (ITN) cond	-.006(.003)* [.019]	-.035(.012)** [.113]	-.002(.003) [.007]	-.014(.013) [.052]
Home care	-.001(.010) [.003]	-.000(.018) [.000]	.030(.008)*** [.011]	.057(.014)*** [.211]
Family/unqualified care	.004(.010) [.013]	.003(.015) [.010]	.009(.008) [.033]	.037(.014)** [.137]
Interactions				
ITN × Home care	.000(.004) [.000]	-.000(.015) [.000]	-.007(.003) [.026]	-.038(.013)** [.141]
ITN × Family/unqualified care	.001(.003) [.003]	.003(.013) [.010]	-.009(.003)** [.003]	-.041(.011)*** [.152]

Note: Center care is reference group (N=75,296).

Standardized coefficients are in brackets. MI models were based on 20 imputed datasets. Time varying control variables are changes from 18 to 36 months in single parenthood, maternal employment, home care and family/unqualified care.

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$.