The Effects of a Universal Child Care Reform on Child Health – Evidence from Sweden

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Abstract: This paper studies the effect of a Swedish universal, public child care reform on child health outcomes. We draw on a unique set of merged population register data from the province of Skåne, following over the period 1999–2008. It contains merged information at the individual level from the population register, the income tax register, the medical birth register and the inpatient and outpatient registers. The outpatient register contains all ambulatory care contacts including all contacts with physicians and therapists. Visits are recorded by day, and diagnoses are recorded for each visit. Our identification strategy relies on a sibling sample design that allows to compare the impact of the reform across siblings within households. Despite exploiting a rather general measure of the reform impact, we additionally make use of detailed information on household-specific monthly child care fee. Our results suggest that children being fully affected by the reform have better physical health at age 4–5 and 6–7, are significantly better off in development and psychological conditions at age 6–7. These effects are particularly distinct for children from low income families, being in line with the literature on early child interventions. Changes in child care prices also predict better physical health for younger children. The results are mainly driven by two mechanisms, a crowding out effect of informal care and a price effect. The findings suggest that the availability of affordable high quality and universal, public child care plays a crucial role for health development throughout childhood. An analysis of children's health costs moreover provides important implications for public health expenditures.

JEL classification: I12, J13, J14, C23, C25, C83

Keywords: child health, universal child care reform Sweden, register data, child care fees

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1 Introduction

In the last decade, European countries have started to expand child care programs in order to influence children's development and well-being at an early stage, and to stimulate maternal labor supply. Early life conditions are very important for the development of human capabilities, as they do not only have short-run effects on human development but persist into the future by determining educational attainment, earnings and health. While small scaled child care programs targeting at children from disadvantaged families, such as Head Start or the Perry Preschool Program, are favored in the US, more and more European countries are implementing universal, public child care arrangements. The idea of the latter concept is that all children benefit from attending an universal child care program in terms of social, physical, cognitive and non-cognitive development, regardless of the family background.

A large body of literature studies the importance of child investment through universal preschooling for early child development. For Germany, Felfe and Lalive (2014) find significant positive effects of center-based child care before age of three on school readiness indicators for children with foreign parents or less educated mothers. Dustman *et al*. (2013) find similar results for children of immigrant ancestry in Germany. In contrast, Baker *et al*. (2008) provide evidence for negative short run effects of the introduction of highly-subsidized universal child care on children's behavior in Quebec, Canada. Using Danish data, Gupta and Simonsen (2010) do not find any effects of child care enrollment at age three on child outcomes at age seven. Exploiting a major child care reform in the 1970s in Norway, Havnes and Mogstad (2011) find large, positive effects on children's long term education and labor market outcomes. In a follow-up study they moreover show that long-term reform effects are heterogeneous along the earnings distribution (Havnes and Mogstad (2014)). Using a regression discontinuity approach, Black *et al*. (2014) estimate the effect of lower child care prices on child outcomes in Norway. They find a significant positive effect of lower child care prices on children's schooling performance, being mainly driven by a positive income effect. Despite the mixed results found in the literature, almost all of these studies exclusively focus on cognitive and non-cognitive measures of child development. Evidence on child health however is scarce.

In this paper we examine the impact of a major reform of universal child care in Sweden in January 2002 on physical and mental child health, and health utilization. The centerpiece of the Swedish child care reform is the introduction of a maximum fee rule which led to considerable cuts in the child care fees for public formal care (Brink *et al*. (2007)). Before the reform each municipality was eligible to set its own child care price level, given the price was reasonable. The introduction of the maximum fee rule imposed a cap on child care prices and set a fixed price structure common to all municipalities. As a main consequence, child care prices significantly dropped and the price variation across municipalities collapsed (Mörk *et al*. (2013)).

Our identification strategy exploits the maximum fee rule reform as an exogenous source of variation in child care prices within the household. More precisely, we compare health outcomes of siblings at the same age being subject to the reform or not within households. The empirical analysis provides us with the sibling-specific health effect of being exposed to the reform. In addition, we use household-level child care prices to assess the impact of the price drop generated by the reform. To eliminate endogeneity issues, we instrument the child care prices

with the introduction of the maximum fee rule. Thus, our empirical strategy allows not only to explore a general reform exposure effect, but also shows the relative importance of a reduction in child care fees for children's health development.

The empirical analysis is based on a unique set of merged register data from the region of Skåne, the southernmost and third most populous province in Sweden. It contains merged individual level information from the population register, the income tax register, the medical birth register, intergenerational register, the inpatient and outpatient register. The health registers are administrated by the Regional Council of Skåne and contain detailed records of all occurrences of inpatient and outpatient care for all inhabitants of the region, covering over 1 million of individuals for 1999–2008. They provide us with detailed information on diagnoses which are recorded for each contact by the ICD-10 disease classification system at the highest level of detail. The ICD-10 codes cover a large range of physical and mental health diagnoses, injuries as well as health care utilization. In addition, the data contain individual health costs per medical contact. Despite the register data, our analysis relies on child care formulas which have been collected from the municipalities before and after the reform. Since child care prices depend on a few characteristics which we observe in the register data we can calculate household-specific child care fees throughout the observation period, allowing us to isolate a potential price effect from other channels.

We find a significantly positive effect of the maximum fee rule reform on children's physical health at age 4–7. Being fully effected by the reform decrease, for instance, the risk for respiratory diseases by 8% at age 4–5, and by about 13% among children aged 6–7, given baseline risks. We moreover find positive long-term impacts of the reform on children's mental health. Among children aged 6–7 years, the incidence of developmental impairments decreases by about 20% in relative terms. For younger children, physical and mental health effects of the reform are small and mostly close to zero. An analysis by income groups suggests that the almost all found health effects are predominantly driven by children from low income families. Together with evidence on a sharp increase in child care attendance rates for age 1–5 in the region of Skåne around the reform implementation data, these results provide us with suggestive evidence of crowding out of informal care arrangements to be the major mechanism at play.

We next investigate the direct impact of the cap in child care prices on children's health development. Decreasing the child care prices by 1% does not have any significant impact on physical health diagnoses in any age group. However, we find robust evidence that the decrease in child care prices is beneficial for children's long term mental health development. Moreover, these effects seem to be mainly driven by children from medium income families. This suggests that changing child care prices increases household income and alters parental investment decisions. Our findings are consistent with predictions from a model of health formation at early ages (see Heckman (2006), Almond and Currie (2011)). In such a setting, the maximum fee rule reform and the induced drop in child care prices present a positive investment shock to child development in a sensitive period. Dynamic complementarity and self-productivity produce multiplier effects that lead large physical and mental health gains at later stages. Health benefits from the reform are achieved via crowding out and income transfers, depending on the children's socioeconomic background.

An alternative model for physical health gains is the so called hygiene hypothesis. This model assumes that

early exposure to germs and certain infections help to develop the immune system (Strachan (1989)). While the incidence of diseases increases at the beginning of the immunization process, the strong immune system protects against future diseases. Even though we do not find any negative physical health effects at early ages, the hygiene hypothesis provide a useful interpretation on how physical health in childhood might develop.

To our knowledge, we are the first who analyze long-term consequences of an universal preschool reform on different dimensions of physical and mental child health, and health utilization. There is only one study by Baker *et al*. (2008) that considers few indicators for child health obtained from parental survey reports. The authors find a negative effect of a universal child care reform in Quebec, Canada, on throat, nose and ear infections in the past 12 months at age 1–2. While Baker *et al*. (2008) could only analyze children's health at a very early stage, our paper advances the understanding of child health development by analyzing child health up to age seven. This allows us to draw more comprehensive conclusions on the predictive power of the health production model and of the hygiene hypothesis. By using a rich set of register data, we can investigate a large number of distinct medical health diagnoses and compare the reform effects for physical health development with those obtained for mental health. Finally, we explore potential channels that link the child care reform and child health, and we show the trend in public health care expenditures of children in our sample. Given these innovations, our study largely contributes to the literature on the importance of child investments in early life (Heckman (2006), Cunha and Heckman (2008), Almond and Currie (2011)), and the implementation of public policies, such as income transfers, to influence child development (for instance, Shea (2008), Tekin (2005), Dahl and Lochner (2012)).

The paper is organized as follows: section two documents the Swedish preschool reform that took effect in 2002. Section three discusses the theoretical considerations and channels to might be at work. The data and the empirical strategy for this study is provided in section four. We present the results in section five. Section six concludes.

2 Institutional Background

2.1 Child care

Sweden has a long tradition in universal child care, leading to very high levels of formal child care utilization compared to other European countries. More than 90 percentage of all children in the age group 3-5 attended child care in 2010 (OECD (2010)). The rates are also very high for children aged 1-2 years (Mörk *et al*. (2013)). One reason for these number is the municipalities' obligations to provide highly subsidized, high quality care to children whose parents are working or studying (during regular office hours). As a result of this policy maternal labor supply in Sweden are very high; In 2000, 86% of mothers with pre-school children and 94% of mothers with school children were employed (Björnberg and Dahlgren (2005)), and the majority of Swedish mothers is working full-time (more than 35 hours/week).

In the early 1990's, the Swedish government transferred the responsibility for the child care sector to the municipalities. The state government left a considerable leeway in the design and implementation of the price schedule

for child care. Moreover, municipalities were allowed to freely set the child care fees to any level, as long as they were "reasonable". In the mid 1990's, Sweden was hit by an economic crisis which led to considerable cutbacks in public spending, also in the child care sector. As a consequence municipalities raised the child care fees, and fixed them more and more to household income and the time children spent at child care. In addition, municipalities introduced different eligibility rules in order to reduce costs[1]. By 1998, child care fees were increased by about 10–15% and the variation in the average prices across municipalities was about 10,000–12,000 Swedish Crones (SEK) per year[2].

Table 1: The maximum fee rule schedule, January 2002

	percent of HH income and maximum fees per child, preschool
1. child	3 percent of HH income – maximum: 1,140 SEK/month (~$135)
2. child	2 percent of HH income – maximum: 760 SEK/month (~$90)
3. child	1 percent of HH income – maximum: 380 SEK/month (~$45)
> 4 children	no charge
maximum total fee per HH	2280 SEK/month (~$270)

Sources: Skolverket 2003.

In 1998, the Social Democrats published an article in a daily newspaper with the title "Halve the fee for day care centers!", proposing a large child care reform with the maximum fee rule as its centerpiece. At the same year, the Social Democrats won the election and the reform bill was passed by parliament in November 2000. They aimed at providing access to child care for all children, improving the economic situation for families with young children and increasing labor supply among parents (Brink *et al*. (2007)). The reform consisted of four parts which have been gradually introduced between January 2001 and January 2003. In a first step, children of unemployed parents received the right for a child care slot for at least 15 hours per week. One year later, this right was extended to children whose parents are on leave. In January 2002 the maximum fee rule was introduced. Even though the implementation was voluntary, all but two municipalities introduced the maximum fee rule. On January 1^{st} 2003, the last package of the reform was implemented. It guarantees a universal preschool free of charge for 15 hours per week for all children age 4–5.

The maximum fee rule is considered as being the most important part of the reform and is the one studied in this paper. Table 1 illustrates the structure of the maximum fee rule. The child care fee schedule consists of two components: First, the fee per child is now determined as a fixed percentage of the household income. Thus, the new child care prices only vary with household income, and the number of children. Second, the prices for child

[1] For example, children whose parents became unemployed could not keep their child care slots. Also, children of parents on leave experienced great difficulties in keeping their slots. Due to such rule child care was not open to all children which became an acute issue.

[2] The municipalities attitude was to give parents the choice for or against care: they could either choose an alternative care or use it and be prepared to pay high fees.

care are capped at a maximum monthly income of 38,000 SEK (≈ 4,100 EUR)[3]. Per household and month, the maximum amount paid for child care was thus set to 2,280 SEK (≈ 240 EUR, for three or more children; see Lundin *et al*. (2008), Mörk *et al*. (2013)). The maximum fee rule not only applies to pre-school child care but also considers after day care.

The reform had far reaching consequences for the child care prices in Sweden: Before the introduction of the maximum fee rule, an average income full-timing working household with two children experienced a price difference across municipalities up to 2,400 SEK/month. After the reform, prices differed only by about 850 SEK/month for the same family type. Moreover, the average child care prices decreased from about 2,800 SEK/month before 2002 to 1,800 SEK/month after the reform, corresponding to a fee reduction of about 12,000 SEK per year for this family type (Skolverket (2003)). The price drop corresponds to a median fee reduction of about 40% for this family type. Even though the price cap was strongest for medium and high income households, the fees were also substantially lower for low income parents.

Figure 1 provides the municipality specific development of child care enrollment rates (a) and child care prices (b) for the years 1999 to 2008. The municipalities considered here all belong to the region Skåne. Panel (a) illustrates the time trend in child care attendance rates by municipality. The light lines in the background are municipality specific trends. The solid line in the front present the municipality averages of child care attendance and child care prices. While they seem to be consistently increasing over time, the slope is steeper around the time the reform was implemented. Panel (b) illustrates the municipality-specific trend in child care fees. It is obvious that prices very different across municipalities before the reform. In 2002, prices are characterized by a large drop. After the reform the prices are on a constantly lower level. Given these patterns one can assume that the increase in child care attendance rates in 2002/03 was driven by the sharp drop in child care fees.



(a) child care attendance rates, age 1–5

(b) child care prices

Figure 1: Development child care attendance rates and child care prices over time

[3] This is the threshold introduced in 2002. In 2004 this value was increased to 42,000 SEK ≈ 4,500 EUR.

One general concern with the new price schedule was that quality of care may decline and that municipalities face excess expenditures for child care. To prevent this scenario, all municipalities received a granted compensation by the Swedish government to implement the reform, to balance the lower fees, and to assure constant child care quality[4]. Table 2 provides the development of few child quality indicators, the municipalities' total preschool expenditures, and the intensive and extensive margin of child care supply. As expected the child care quality was kept on a constant level over time, having an average group size of about 5.4 children per case worker. Moreover, the fraction of child care staff with pedagogical training remained unchanged. Municipality-specific expenditures as well as the number of child care facilities increased over time, but seem not to discontinuously jump to a higher level in 2002–2003. The only notable increase around the time of the reform can be found for the total number of child care personnel. However, this number keeps increasing in the later years as well. Given the numbers in table 2 we therefore do not expect any negative trends in the quality of public child care due to the maximum fee rule reform. Any increased demand for child care has been remedied by a moderate increase in child care staff, not by impairments in child quality though (see also Mörk *et al*. (2013)).

Table 2: Child quality, municipal expenditures and supply in Skåne, 1999-2008

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Enrolled children per caseworker	5.3	5.6	5.4	5.4	5.5	5.5	5.4	5.2	5.2	5.3
share of personnel with pedagogical training,%	54	55	55	54	55	54	54	54	54	55
municipal expenditures per child in SEK, 2010 prices	93,695	95,667	97,753	100,777	99,600	99,580	104,199	110,997	113,591	115,351
total number of child care staff	6,537	5,921	6,066	6,474	6,898	7,073	7,677	8,255	8,661	8,901
number of preschool institutions, entire Sweden	.	6,283	6,114	6,371	6,616	6,576	6,769	7,076	7,324	7,447

source: Skolverket, 1999-2008, these numbers refer to public child care facilities

2.2 Health care

In Sweden, health care is mostly public and organized at the region level. Within a region, different municipalities have different health care centers that house all outpatient care. The region of Skåne hosts nine hospitals, 150 local health care centers (primary care units), and one University hospital in the city of Lund. Typically, a rural community has only one center, and larger cities have multiple centers. Every individual is assigned to exactly one health care center which usually is the nearest center. Each center has a team of physicians, first-aid workers, and nurses. In case of a need to see a health care worker, including first-aid and emergency aid, an individual goes to the center and is helped by the next available appropriate health care worker. There is no path dependence in the identity of the health care worker across consecutive contacts. For a given contact reason, on a given day,

[4] Note that child care was heavily subsidized already before the reform. User charges counted for about 16% of the municipalities' total costs for child care in 1999 and about 10% in 2003 (Brink *et al*. (2007)).

incoming individuals are dealt with sequentially by the first available health care workers. Workers in the health care sector (from nurses to hospital specialists) are county civil servants. The health care system is funded through a proportional county tax on income. Health care usage is free, with the exception of a small deductible which in our observation window is capped at about 80 euro per adult person per year.

3 Theoretical considerations & potential channels

According to the unitary household model, we assume that parents maximize the household utility by making choices on own consumption and child quality subject to budget and time constraints. Child quality consists of different input factors and is produced by either monetary investments in formal child care and by purchasing market goods for children, or by time investments. Market goods are for instance books, music lessons, or sports. Child health is one dimension of child quality, and its consumed quantity can be altered by changes in child care prices. Households react differently to changes in child care prices, depending on the level of child care before the reform, parental preferences for formal care, as well as income and substitution effects on parental consumption and child quality. Thus, the magnitude and the direction of the maximum fee rule reform on child health is ex ante ambiguous (Havnes and Mogstad (2014)).

There might be several mechanisms linking the maximum fee rule and child health development and utilization. First, the availability of affordable child care may decrease maternal time investments devoted to child care. The additional time may lead to an increase maternal labor supply. This generates additional household income which can be used for the production of child quality (Black *et al*. (2014)).[5]. Alternatively, lower maternal time investments in informal child care may increase quality of the remaining time devoted to the child. Moreover, it may be used to produce other household goods that are inputs for child quality. Second, the cap in child care prices might serve as a positive income transfer. The additional disposable income may be used by parents for monetary investments in child quality[6]. In this case, changes in child health are driven by an income effect induced by the cap in child care prices. A third channel may be fertility. If child care fees decrease households could afford more children. Siblings may be an important factor for social development and physical health. The literature has shown that a bigger family size has positive effects on child health, since a greater exposure to infections early in life is beneficial for the immune system (Lundborg *et al*. (2013)). Finally, child health may be influenced by lower child care fees through the direct crowding of informal care arrangements (Havnes and Mogstad (2011)). If quality of formal care is higher than for informal care arrangements, this substitution process may positively influence child development and child health.

[5] For parents that did not buy child care before the reform increased labor supply at the extensive margin represents a reasonable channel for the reform effect. Parents that already had e.g. half-time slots of public child care the positive effects of the price change on child health may work through increased hours of work.

[6] For example, the additional income may now be spent on purchasing market goods, such as lessons for playing an instrument or buying more books.

Some of these channels have been under investigation. Lundin *et al*. (2008) analyze the impact of the maximum fee rule on mother's labor supply using similar administrative data from Sweden as we are using. They do not find a net increase in female labor supply, neither on the extensive nor on the intensive margin. Havnes and Mogstad (2014) exploit an exogenous increase in child care supply in Norway also finding almost no impact on labor supply of married mothers. Instead this Norwegian child care reform crowds out informal care arrangements (see also Havnes and Mogstad (2011)). In a similar way for Germany, Felfe and Lalive (2014) find a substitution from the time spent with the mother and other informal care provider, to time spent in the child care. Mörk *et al*. (2013) find limited effects of the price changes on the fertility behavior of Swedish families. While they provide evidence for an increase in first birth for formerly childless couples, the authors find only weak effects on timing of higher order births. Finally, Black *et al*. (2014) show that the eligibility for lower child care fees improves children's schooling performance at the junior high school level. Their findings suggest that the predominant mechanism is an income effect generating increased parental investments. Due to the limited effects of the maximum fee rule reform on labor supply and fertility, we will investigate two major channels in this paper, namely crowding out of informal care arrangements and an income effect induced by the drop in child care prices.

We assume that physical and mental health both underlay a dynamic development that can be explained by two different approaches. First, the child care reform can be viewed as a positive investment at an early period in life, producing a higher stock of health at later stages (Heckman (2006), Almond and Currie (2011)). The process of health formation is characterized by two features. "Self productivity" implies that the stock of good health at early age translates into good health at later stages. "Dynamic complementarity" defines the process that a high level of health makes later investments more productive. Together these two features provide the mechanism through which early childhood health begets later childhood or adult health (Cunha and Heckman (2008)). An alternative approach to consider health development throughout childhood is the so called hygiene hypothesis (Strachan (1989)). Originally, this hypothesis states that a lack of early childhood exposure to infectious agents increases the susceptibility to allergic diseases by suppressing the natural development of the immune system. The immunization process itself is considered to be more effective for early childhood exposure. Even though highly debated, the medical literature has shown that child care attendance and the related exposure to more frequent early infections is a protection against specific future diseases Ball *et al*. (2000). The predictions of the hygiene hypothesis stand in contrast to those of the model of health formation for poor health of young children. While the former predicts positive long term health effects from a negative health shock at early age, the latter predicts increased health deficits in later childhood if parents cannot sufficiently increase health investments and there is no remediation at later stages.

4 Data and Empirical Strategy

4.1 Data

The analysis is based on a unique set of merged population register data from the province of Skåne, the southernmost and third most populous region in Sweden. This data follows a large subset of the population of Skåne over the period 1999-2008[7]. It contains merged individual level information from the population register, the income tax register, the medical birth register and the outpatient register.

Child health outcomes are derived from individual health care records in the 1999–2008 "patient administrative register systems" PASiS and PRIVA from the region of Skåne. These two registers are administrated by the Regional Council of Skåne and contain detailed records of all occurrences of inpatient and outpatient care for all inhabitants of the region. Here, "inpatient" refers to visits or spells at medical units that include at least one night's stay. These are mostly overnight hospital treatments. "Outpatient" refers to all other contacts with care providers, i.e., all ambulatory care, such as day-time visits to physicians, dentists, therapists, emergency care units, specialized nurses, and physiotherapists. In addition, it covers consultations by telephone. Visits are recorded by day, and diagnoses are recorded for each visit. The diagnoses are at the highest level of detail of the ICD-10 classification system. The ICD-10 codes cover a large range of physical and mental health diagnoses, injuries as well as health care utilization information such as (preventive) checkups and vaccinations. For our purpose we collapse most of the detailed 3-digit ICD10 codes into 2-digit main categories and construct binary variables that indicate whether a person was diagnosed with a specific disease.

As noted earlier in the paper, most health care is public. However, some care providers (notably dentists) are private. PASiS contains all publicly provided care, whereas PRIVA contains all privately provided care. The information in PASiS and PRIVA includes dates of admission and discharges, as well as detailed diagnoses and DRG-based costs. These registers have previously been used by Kristensson *et al*. (2007) and Tertilt and Van den Berg (2014). At the county level, the health care registers are collected because they determine the monetary streams from the county to the various health care centers and hospitals. At the same time, at the national level, the register data are collected as part of the so-called "National eHealth" endeavor to improve efficiency in health care. Here, institutional variation in the health care systems across counties is used for "natural experiments" in the analysis of the connection between health care diagnoses and treatments and health outcomes. For this reason, the national health authorities place great value in the collection of reliable health-care diagnosis records.

In Sweden, each individual has a unique identifier which is used to record all contacts with the health care system as well as the general public administration, tax boards, employment offices and so on. We use this to match the above-mentioned health care registers to individual information on socio-economic and demographic conditions. Specifically, we merge these registers to a data set that itself consists of a number of different registers. It includes variables from the annual LISA register on income by type, work absence days, detailed education measures, as well as information on date of birth, marital status, vertical family connections across different individuals, and migration status. This data set is annual, in the sense that each variable is only recorded once a year. This data set

[7] Specifically the data set contains all people born between 1940 and 1985 and their family trees.

has been used before by Meghir and Palme (2005) and covers all persons born in Sweden between 1940 and 1985, their parents, and all their children.

Table 3: Descriptive statistics: health outcomes & health utilization

	age 1–3		age 4–5		age 6–7	
	N = 69,805		N = 63,538		N = 58,310	
	mean	sd	mean	sd	mean	sd
viral infect	0.09	0.29	0.05	0.22	0.03	0.18
middle ear infect	0.18	0.39	0.15	0.35	0.10	0.30
chicken pox	0.01	0.07	0.00	0.06	0.00	0.04
infections, all	0.15	0.35	0.08	0.28	0.06	0.23
ear diseases	0.19	0.39	0.16	0.37	0.12	0.32
respiratory diseases	0.30	0.46	0.22	0.41	0.17	0.38
skin diseases	0.08	0.27	0.07	0.25	0.06	0.23
other diseases	0.10	0.30	0.08	0.27	0.08	0.27
developmental impairment	0.01	0.12	0.08	0.27	0.04	0.20
psychological, all	0.02	0.14	0.09	0.27	0.06	0.24
preventive visit	1.62	2.26	0.81	0.88	0.30	0.59
diagnoses per year	2.40	4.06	2.30	4.35	1.86	3.58
visits per year	6.46	6.31	4.69	5.37	3.47	4.85

We augment the data with information from Statistics Sweden, namely municipality-specific unemployment rates and population density. This is important information, since they may determine the child care fees before the maximum fee rule was introduced. We construct a panel data set in which we observe each child born between 1993–2004 and living in the region of Skåne between 1999–2008[8]. We restrict our analysis to household with parents that are married or cohabiting[9]. We set up a sibling sample, containing all remaining households with at least two and a maximum of four children. In order to prevent our estimates from being confounded by the part of the reform addressing children with unemployed parents, we additionally drop households with at least one parent being unemployed just before the reform. The corresponding sibling sample consists of 191,653 observations for 46,453 siblings observed at the same age 1–7, and a maximum of 10 waves.

As outcomes, we select a number of diseases as outcomes children have been diagnosed with and we categorize

[8] We are aware that this excludes all children from the sample that did not have any contact to a medical provider.

[9] Unfortunately, we do not observe new partners of children' parents. Moreover, we do not have any information on alimony payments. Thus we cannot calculate the child care fees for families with separated or divorced parents.

them along three different groups. The first group one denotes physical health outcomes which can be broadly divided into infections, ear diseases, respiratory diseases, skin diseases, accidents from intoxication or fractions, and other diseases. In addition, we consider few specific subcategories: viral infections, middle ear infections, and chicken pox. We select these health outcomes, since they record typical child diseases that are not innate. The second group are mental health outcomes. Since the incidence of such diagnoses are rarely made during early childhood, we only take measures of developmental impairments and general psychological health. The latter category comprises diagnoses on ADHD and intellectual problems. Health utilization defines the third category of outcomes. We analyze preventive (scheduled) and acute visits as well as the number of medical visits and the number of diagnoses made per year. Table 3 displays the mean incidence of the outcomes by age group.

4.2 Empirical Strategy

Our analysis relies on a sibling sample design. To estimate an overall reform effect we compare health outcomes of siblings in households that were fully affected by the reform versus siblings that were only partly or not affected by the reform. Since the reform took effect in January 2002 for all children aged 1–7 years, those born after December 2000 were subject to the reform at each age. Birth cohorts born before January 2001, were partly covered by the reform. We choose three different age groups to measure potential health effects: 1–3, 4–5, and 6–7. Figure 2 illustrates how two hypothetical siblings with a certain birth spacing are compared to each other over time. Here, the younger sibling is fully exposed to the reform, while the older sibling is not affected before age of three. We decide for this type of age-dependent comparison because child health follows an age trend which we assume to be the same for both siblings and is shifted downwards for the exposed sibling.

We set up a linear model that links health outcomes of child i in household j and municipality m at year t to dummy of full reform exposure $exposed_{ijm}$ and covariates.

$$Y_{ijmt,age=a} = \alpha_j + \beta exposed_{ijm} + X_{ijmt}\delta + \vartheta_t + \varphi_m + \epsilon_{ijmt}. \tag{1}$$

In this specification, α_j is a household fixed effect, ϑ_t is a linear time trend, φ_m is a municipality fixed effect, X_{ijmt} are covariates and ϵ_{ijmt} is an iid error term[10]. Equation (1) is separately estimated for each age group with outcomes $Y_{ijmt,age=1-3}$, $Y_{ijmt,age=4-5}$, and $Y_{ijmt,age=6-7}$. We estimate a linear probability panel model with sibling fixed effects, obtaining an intention to treat (ITT) effect of full reform exposure on the probability of getting diagnosed with specific diseases at a particular age.

While equation (1) provides us with an estimate for the full reform exposure, we use information on the price schedules to evaluate the relative importance of changes in child care prices as a potential mechanism. Municipality-specific price formulas are collected by a survey and allow to calculate the child care fees in the years before and after the introduction of the maximum fee reform on the household level[11]. The household-specific child care fees

[10] Given a linear time trend, we expect differences across children at the same age not to be driven by calendar time. Under this assumption it is sufficient to control for a linear time trend over age only.

[11] Child care prices were collected by Eva Mörk and colleagues via an email-request sent to all Swedish municipalities asking for the exact price formulas. They received complete information from 220 of Sweden's 290 municipalities. For the region of Skåne 26 of 33 municipal-

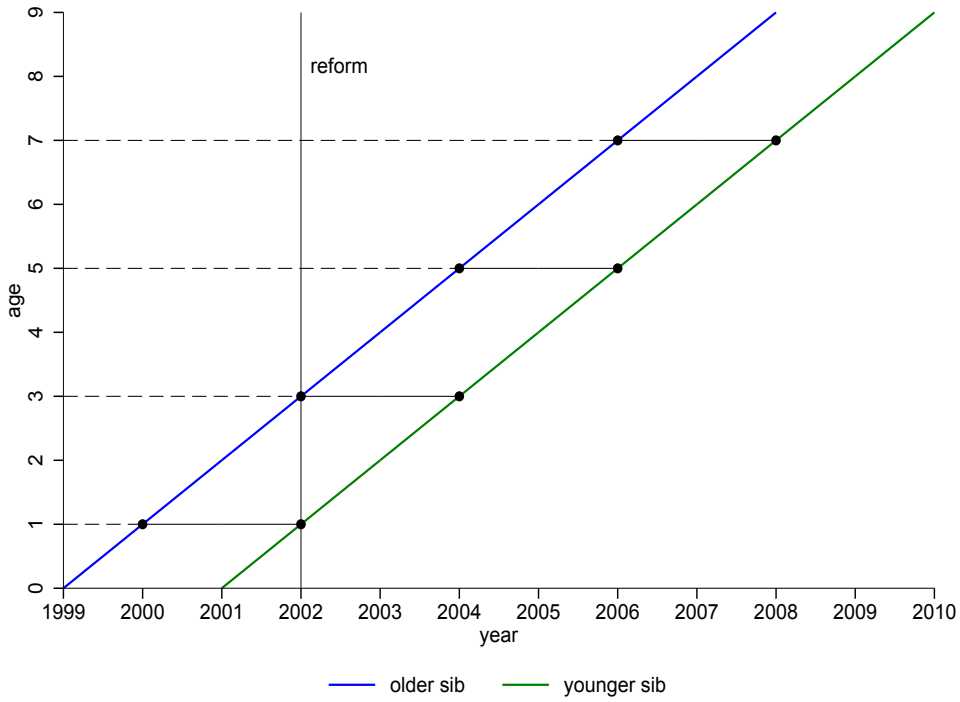


Figure 2: comparison of siblings by age and reform exposure

in each municipality is a function of household income, age and number of children (Lundin *et al*. (2008), Mörk *et al*. (2013)):

$$P_{jmt} = f_m\left[\text{HH income}_{jt}, \text{age children}_{jt}, \text{nr children}_{jt}\right] \tag{2}$$

where m denotes the municipality, j refers to a specific household and t is the calendar time. Prices can be calculated for all households with at least one child aged 1–9 years in the register data[12]. Since we do not observe child care attendance rates on the individual level, we assume that all children of childcare eligible age are enrolled in full-time childcare. Tracing back to the sibling level and taking the logarithm of the calculated child care prices, leads to the following specification linking log child care prices and child health.

$$Y_{ijmt,age=a} = \alpha_j + \gamma \log(fee)_{ijmt} + X_{ijmt}\delta + \vartheta_t + \varphi_m + \epsilon_{ijmt} \tag{3}$$

The coefficient γ provides us with an estimate of the percentage point change in the probability of being diagnosed with any diseases if child care prices across siblings at the same age increase by one percent. Since the maximum fee rule reform imposed a price cap, we expect that higher child care prices go along with higher adverse health risks, and vice verse.

One issue with the child care prices is that they may be endogenous. In particular, we have to assume that household

ities provided this information. Thus we exclude the municipalities Svalöv, Burlöv, Vellinge, Östra Göinge, Höör, Klippan and Lund from our analysis

[12] Due to our data restrictions we only analyze children's health outcomes below age of 8.

income is not exogenously determined. In addition, the family income clearly affects child health at each age. It has been shown that investments in child health depends on disposable family income (see for instance Case *et al.* (2002), Currie and Stabile (2003)). Consequently, any unobserved changes altering household income and child health may also change the child care prices. We reply to this issue by exploiting the exogenous variation in child care prices induced by the maximum fee rule reform. Equation (4) shows the first stage specification.

$$\log(fee)_{ijmt,age=a} = \alpha_j + \pi reform_{ijmt} + X'_{ijmt}\delta + \vartheta_t + \varphi_m + \zeta_{ijmt}. \tag{4}$$

The variable $reform_{ijmt}$ is the reform dummy taking the value one in the year 2002, and is zero otherwise. We again account for household fixed effects, municipality fixed effects and a linear time trend. We expect a strong negative shift of the child care prices stemming from the timing of the reform. We add a number of covariates to all regressions: gender, the annual household income, the number of kids in household, the number of older siblings, whether a child moved, children's log birth weight, whether children are twins, the local unemployment rate and local population density. We cluster the standard errors on the household level in the baseline regressions, but we will also consider clustering on the municipality level and the municipality-by-year level.

5 Results

We estimate equations (1) and (2) for age groups 1–3, 4–5 and 6–7. We account for these age groups for several reasons. First, it has been shown that children at different ages suffer from different diseases, and we would like to take account of this heterogeneity. Second, the effects of the maximum fee rule reform might be dynamic in the sense that we obtain negative effects on physical health at younger ages and positive effects at later ages. Finally, children aged 6–7 are at preschool or elementary schooling age. Positive health effects for these children could be interpreted a long run gains from the child care reform[13].

5.1 Main reform effects

Table 4 displays the results obtained from estimating equation (1). For children's physical health we only find very small or zero effects of being fully exposed to the reform compared to their siblings at age 1–3. However, the impact of the reform exposure on child health at age 4–5 is significantly different from zero for a number of physical health measures. Being fully exposed to the reform decreases the probability of suffering from viral infections by 0.9 percentage points, from middle ear infections by 1.8 percentage points, and from chicken pox by 0.3 percentage points. In addition, we find significantly lower probabilities of suffering from general infections (1.6 percentage points), ear diseases (2.4 percentage points), respiratory diseases (2.2 percentage points) skin diseases (1.0 percentage points) as well as from other disease (1.5 percentage points).

[13] We also estimated all regressions for different ages groups and for single age. The results are available upon request.

Table 4: Effects of reform exposure on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
exposed	-0.005	-0.014*	0.002	-0.002	-0.014*	0.008	0.009*	0.004
	(0.005)	(0.007)	(0.001)	(0.006)	(0.008)	(0.008)	(0.005)	(0.006)
N×T	66,807	66,807	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866	13,866	13,866
				age 4–5				
exposed	-0.009**	-0.018**	-0.003**	-0.016***	-0.024***	-0.022***	-0.010**	-0.015***
	(0.004)	(0.007)	(0.001)	(0.006)	(0.007)	(0.008)	(0.005)	(0.005)
N×T	60,745	60,745	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423	17,423	17,423
				age 6–7				
exposed	-0.009**	-0.022***	-0.001	-0.008	-0.021***	-0.031***	-0.012**	-0.017***
	(0.004)	(0.007)	(0.001)	(0.006)	(0.008)	(0.009)	(0.006)	(0.006)
N×T	55,848	55,848	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

The effect of being fully exposed to the reform persists into age 6–7 for almost all physical health diagnoses. Children in this age group have 2.1 percentage points lower risk of being diagnosed with ear diseases, and a 3.1 percentage points lower risk of being diagnosed with respiratory diseases compared to their non-exposed siblings. The findings in table 4 indicate that full exposure to the reform is beneficial for physical child health at older age.

Table 5: Effects of reform exposure on children's psychological health and health behavior

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	-0.003	-0.007**	0.049	-0.008	-0.054	-0.011
	(0.002)	(0.003)	(0.086)	(0.101)	(0.034)	(0.026)
N×T	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866
			age 4–5			
exposed	0.004	0.003	-0.184*	-0.233**	-0.024	0.039*
	(0.006)	(0.006)	(0.098)	(0.103)	(0.015)	(0.021)
N×T	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423
			age 6–7			
exposed	-0.009**	-0.015***	-0.123*	-0.277***	-0.075***	0.021
	(0.004)	(0.005)	(0.074)	(0.091)	(0.012)	(0.021)
N×T	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

The results for mental health effects and health utilization are presented in table 5. At age 1–3 the probability of being diagnosed with psychological impairments is 0.7 percentage points lower if a child was subject to the reform. Despite this, we do not find any significant effects on the number of diagnoses per year or the number of medical contacts. While no positive mental health effects of the reform can be found for age 4–5 either, the probability of having psychological impairments significantly decreases by 1.5 percentage points at age 6–7. In addition, we find a 0.9 percentage point decrease in the probability of being diagnosed with developmental problems in this age group. Health utilization seems to be significantly influenced by the reform at later age. The number of diagnoses as well as the number of medical visits per year decreases significantly. Moreover, children age 6–7 show 28 percentage points lower rate for preventive visits.

The estimates are of considerable size when interpreted along given baseline risks, ranging between 6% to 20%.

For example, the probability of viral infections decreases by about 13%, and the probability of ear diseases by about 12% in relative terms at age 4–5. At age 6–7 the rate for ear infections decreases by about 14% and there are about 13% less diagnosis on respiratory diseases. In this age group, psychological impairments and developmental impairments have an about 20% lower incidence rate if the sibling was fully exposed to the reform. Finally, the number of annual medical visits decreases by about 8% and here are about 19% less preventive visits registered.
Overall, the results suggest that the maximum fee rule reform has long-term physical and mental health benefits. One concern with our estimates is that we do not observe enrollment in child care on the individual level. The ITT might understate the average treatment effect of the introduction of the maximum fee rule reform if enrollment rate are particularly low for specific age groups.

5.2 Reform effects by income

The main consequence of the maximum fee rule reform was a significant drop in the child care fees. While the cap in child care prices may have led to additional disposable income for all household, it makes child care more affordable for low income households. If a proportionally larger fraction of children from low income household did not attend child care before the reform, we expect that the positive effects on child health are mainly driven by this group.
We define three distinct income groups. Children from households whose household income in 2001 was below the 25^{th} percentile of the income distribution belong to a low income household. Families whose household income in 2001 lied above the 75^{th} percentile of the income distribution are denoted as high income households. Accordingly, medium income households have a household income in 2001, that is between the 25^{th} and 75^{th} percentile of the household income distribution in 2001.
Table 6 and table 7 show the results from estimating the reform effects for the three income groups separately. The first panel of table 6 illustrates the effects of the reform exposure for children aged 1–3 years. Children from low income families do not experience any physical health benefits from the reform. In this age group, we find increased incidence for chicken pox for children from medium and high income families.
The estimation results for children aged 4–5 are displayed in the second panel of table 6. Children from low income families largely benefit from the maximum fee rule reform along almost of dimensions of physical health. The risk of being diagnosed with viral infections at age 4–5 significantly decrease by 2.1 percentage points, and by 2.8 percentage points for general infections. Moreover, children from low income families are significantly less likely to be diagnosed with ear diseases (2.2 percentage points), respiratory disease (4.2 percentage points) and skin diseases (1.9 percentage points). We also find positive effects of the child care reform on physical health for children from medium income households. The impact is strongest for ear diseases, middle ear infections, and skin-related diagnoses. In contrast, we almost never find any significant health effects from the reform for children from high income families.

Table 6: Effects of reform exposure on children's physical health, by household income in 2001

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3, by log income in 2001				
$N = 22,844$								
low: *exposed*	-0.010	-0.013	-0.003	-0.009	-0.009	-0.004	0.002	0.005
	(0.009)	(0.012)	(0.002)	(0.010)	(0.012)	(0.013)	(0.009)	(0.009)
$N = 20,422$								
med: *exposed*	0.004	-0.006	0.005*	0.010	-0.009	0.007	0.016	-0.005
	(0.010)	(0.013)	(0.002)	(0.011)	(0.014)	(0.015)	(0.010)	(0.011)
$N = 15,013$								
high: *exposed*	-0.014	-0.018	0.006**	0.002	-0.023	0.010	0.005	0.032***
	(0.011)	(0.015)	(0.003)	(0.014)	(0.016)	(0.018)	(0.012)	(0.012)
				age 4–5, by log income in 2001				
$N = 18,875$								
low: *exposed*	-0.021***	-0.018	-0.004*	-0.028***	-0.022*	-0.042***	-0.019**	-0.014
	(0.007)	(0.012)	(0.002)	(0.009)	(0.012)	(0.013)	(0.009)	(0.009)
$N = 19,498$								
med: *exposed*	-0.005	-0.022*	-0.003*	-0.009	-0.031**	-0.015	-0.020**	-0.021**
	(0.008)	(0.012)	(0.002)	(0.010)	(0.013)	(0.014)	(0.009)	(0.009)
$N = 17,299$								
high: *exposed*	-0.002	-0.008	0.001	-0.009	-0.014	-0.014	0.018*	0.001
	(0.008)	(0.014)	(0.002)	(0.011)	(0.015)	(0.015)	(0.010)	(0.011)
				age 6–7, by log income in 2001				
$N = 15,556$								
low: *exposed*	-0.012*	-0.012	-0.001	-0.008	-0.014	-0.036***	-0.017*	-0.006
	(0.007)	(0.012)	(0.002)	(0.009)	(0.013)	(0.015)	(0.010)	(0.011)
$N = 18,055$								
med: *exposed*	-0.010	-0.027**	-0.001	-0.012	-0.020	-0.019	-0.019*	-0.023**
	(0.007)	(0.013)	(0.001)	(0.010)	(0.013)	(0.015)	(0.010)	(0.011)
$N = 18,876$								
high: *exposed*	-0.001	-0.020	-0.001	-0.001	-0.025*	-0.052***	-0.008	-0.016
	(0.008)	(0.014)	(0.001)	(0.011)	(0.014)	(0.016)	(0.011)	(0.012)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality. Observations are grouped along tertiles of the log household income in 2001.

Table 7: Effects of reform exposure on children's psychological health and health behavior, by household income in 2001

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3, by log income in 2001			
$N = 22,844$						
low: *exposed*	0.005	-0.000	0.032	-0.430***	-0.261***	0.055
	(0.004)	(0.004)	(0.143)	(0.166)	(0.053)	(0.043)
$N = 20,422$						
med: *exposed*	-0.008**	-0.016***	0.075	0.093	0.125**	-0.067
	(0.004)	(0.005)	(0.150)	(0.183)	(0.061)	(0.047)
$N = 15,013$						
high: *exposed*	-0.006	-0.004	-0.100	0.381*	0.240**	-0.071
	(0.004)	(0.005)	(0.185)	(0.202)	(0.075)	(0.056)
			age 4–5, by log income in 2001			
$N = 18,875$						
low: *exposed*	0.006	0.005	-0.251	-0.447**	0.031	0.021
	(0.010)	(0.010)	(0.184)	(0.188)	(0.025)	(0.035)
$N = 18,498$						
med: *exposed*	0.004	0.001	-0.197	-0.146	-0.071***	0.042
	(0.010)	(0.011)	(0.147)	(0.173)	(0.026)	(0.037)
$N = 17,299$						
high: *exposed*	-0.000	-0.002	-0.132	-0.018	-0.054*	0.077*
	(0.012)	(0.012)	(0.176)	(0.174)	(0.030)	(0.042)
			age 6–7, by log income in 2001			
$N = 16,142$						
low: *exposed*	-0.013	-0.022**	-0.295**	-0.643***	-0.092***	-0.010
	(0.008)	(0.010)	(0.129)	(0.154)	(0.021)	(0.036)
$N = 18,679$						
med: *exposed*	-0.001	-0.009	0.002	-0.105	-0.050**	0.001
	(0.008)	(0.009)	(0.121)	(0.144)	(0.021)	(0.037)
$N = 19,440$						
high: *exposed*	-0.006	-0.003	-0.061	-0.056	-0.063***	0.050
	(0.009)	(0.010)	(0.149)	(0.165)	(0.024)	(0.040)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality. Observations are grouped along tertiles of the log household income in 2001.

At age 6–7 physical health effects of the reform are distributed across age groups. For children from low income families, we find significantly lower probabilities of suffering from respiratory diseases, viral infections and skin diseases. Children from median income households have a significantly lower probability of 2.7 percentage points of being diagnosed with middle ear infections and of 2.3 percentage points of being diagnose with other diseases. Children with high income background are significantly less likely diagnosed with ear diseases, and respiratory diseases By comparing these findings with the results in table 4 we may conclude that the health effects of the maximum fee rule reform are mainly driven by children from low or median income families.

Table 7 provides us the results for mental health and health utilization. Children from median income household benefits most from the reform in terms of developmental and psychological impairments at age 1–3. Compared to their siblings this group of exposed children shows a significantly lower probability of 0.8 percentage points of being diagnosed with developmental problems. Moreover, they have a 1.6 percentage points lower risk for mental health issues. Interestingly the impact of the child care reform goes toward different directions for health utilization for different income groups. While children from low income families exhibit lower number of annual medical contacts and preventive visits, the opposite is true for medium and high income families.The findings for medium/high income children at age 1–3 might be explained by changed parental behavior.

We do not find any significant impact of the maximum fee rule reform on mental health at age 4–5. However, children from low income households see the doctor less often, which was expected given the results for physical health. We find a lower number of preventive visits due to the reform for children from medium and high income families. Finally, children at age 6–7 with disadvantageous background show a significantly significantly lower risk of 2.2 percentage points for being diagnosed with psychological impairments if they were fully affected by the maximum fee rule reform. Moreover, this group of children shows significantly fewer annual medical visits, fewer medical diagnoses per year, a lower number of preventive visits, but no significant changes in acute visits. This indicatie that the reform improved their overall health rather than switching from scheduled to unscheduled medical visits.

Our findings are strongly supported by the literature. As discussed by Currie (2001) children with low socioeconomic background strongly benefit from early interventions, such as Head Start or the Perry Preschool program. The main goal of such programs is to equalize initial endowments between children with different socioeconomic backgrounds. Our findings suggest that also an affordable universal, public child care arrangements improves the physical and mental health prospects of disadvantaged children. Our results are moreover in line with the literature on the effects of universal child care programs (Berlinski *et al*. (2009), Felfe and Lalive (2014), Dustman *et al*. (2013)).

5.3 Child care fees

The earlier analysis has revealed considerable health effects for children being fully exposed to the reform compared to their non-exposed siblings. We now add an empirical analysis that allows to assess the price effect on

child health associated with the maximum fee rule reform[14].

As outlined in section 4, the child care prices might be endogenous which makes us using the timing of implementation of the maximum fee rule reform as an instrument. Table 8 presents the results from estimating the first stage. The relationship between the timing of the maximum fee rule reform and the log child care prices is negative and significantly different from zero for all age groups. The obtained coefficients imply a significant drop in child care prices by approximately 41%–49% due to the implementation of the reform. The R^2 shows that between 68% and 75% of the variation in child care prices can be explained by the reform, and the F-statistics is sufficiently high to assume that the instrument is relevant.

Table 8: First stage regression of maximum fee rule reform implementation on logarithm of child care fees

	log(fee)		
	age 1–3	age 4–5	age 6–7
$reform$	-0.414***	-0.478***	-0.492***
	(0.003)	(0.005)	(0.004)
N×T	66,687	60,660	55,772
N	13,857	17,416	14,956
R^2	0.751	0.679	0.712
F statistics	14,223	11,318	14,585
p-value	0.000	0.000	0.000

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

The estimation results from the second stage with family fixed effects are presented in table 9 and table 10. In contrast to the findings in table 4, there is no direct impact of a reduction in child care prices on physical health development. This indicates that prices and potential positive income transfers to families do not matter for physical health investments.

Results for mental health and health utilization are presented in table 10. We find significantly positive effects of lower child care prices on the long term mental health development. Children aged 6–7 that were exposed to the reform show a 1.5 percentage points lower probability of getting diagnosed with developmental impairments. In addition, the risk for getting diagnosed with general mental health issues is reduced by 1.7 percentage points in this age group. Lower child care fees improve children's mental health in the long run, a finding which is consistent with the literature (Black *et al*. (2014)). While children aged 4–5 show significantly more annual medical visits, and both preventive visits and acute visits, the number of medical diagnoses per year is significantly reduced at age 6–7. This result is surprising compared to the findings in table 5. One potential explanation is that public child

[14] This identification strategy is similar to the one used in Lundin *et al*. (2008) and Mörk *et al*. (2013)).

care providers pay more attention to children's health and children have to see the doctor as soon as there is any suspicion for a disease.

Table 9: Effects of log child care prices on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
log (fee)	0.007	-0.003	0.001	0.004	-0.004	0.012	0.004	0.013
	(0.008)	(0.010)	(0.001)	(0.010)	(0.010)	(0.012)	(0.007)	(0.009)
K-P statistic				5,413				
F statistic				14,623				
N				66,495				
				age 4–5				
log(fee)	-0.004	-0.014	0.001	-0.003	-0.013	-0.006	0.008	0.001
	(0.006)	(0.010)	(0.001)	(0.008)	(0.011)	(0.011)	(0.007)	(0.008)
K-P statistic				4,329				
F statistic				12,904				
N				60,384				
				age 6–7				
log(fee)	0.002	-0.014*	0.000	-0.002	-0.011	-0.015	-0.000	0.001
	(0.005)	(0.008)	(0.001)	(0.006)	(0.008)	(0.010)	(0.007)	(0.007)
K-P statistic				4,600				
F statistic				14,120				
N				55,569				

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; IV sibling fixed effects regression and control for a linear time trend and municipality fixed effects. log fees are instrumented by reform exposure dummy. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table 10: Effects of log child care prices on children's psychological health and health behavior

			age 1–3			
	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
log(fee)	0.002	0.005	0.136	0.008	0.056	-0.223***
	(0.003)	(0.004)	(0.088)	(0.126)	(0.054)	(0.041)
K-P statistic			4,932			
F statistic			13,159			
N			61,528			
			age 4–5			
log(fee)	0.010	0.013*	0.086	-0.227**	-0.075***	-0.100***
	(0.007)	(0.007)	(0.094)	(0.113)	(0.024)	(0.035)
K-P statistic			4,329			
F statistic			12,904			
N			60,384			
			age 6–7			
log(fee)	0.015***	0.017**	0.205***	0.026	-0.035*	-0.023
	(0.005)	(0.007)	(0.077)	(0.093)	(0.018)	(0.023)
K-P statistic			4,600			
F statistic			15,120			
N			55,569			

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; IV sibling fixed effects regression and control for a linear time trend and municipality fixed effects. log fees are instrumented by reform exposure dummy. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

In order to get an idea about a effect of having lowered the child care prices, we again split the sample along the tertiles of the household income distribution in 2001[15]. We find suggestive evidence that the long term mental health effects of the price change are mostly driven by children from median income families. The effects for children from low income families are very close to zero. Since there is no evidence for an increase in hours of

[15] The results are available upon request.

child care (see Solverket 2003), we assume that the change in child care prices served as an income transfer to families which might have improved child-specific investments.

5.4 Discussion of mechanisms

Given the observed effects of the maximum fee rule reform on different dimensions of child health, the next question is how the results for different reform measures fit together, and what factors are driving these results. As mentioned in section 3 we assume that two major mechanisms link the maximum fee rule reform and child health in our setting[16].

First, the maximum fee rule reform guarantees broader access to public child care, leading to a crowding out effect of informal care arrangement. Havnes and Mogstad (2011) provide evidence for Norway that newly subsidized child care crowds out most of the informal care arrangements. In our setting, the lower child care prices imposed by the reform make public child care affordable to households at the lower end of the income distribution. For children affected by the reform, these household substitute public child care for private or informal care arrangements. As public child care arrangements in Sweden are of very high quality, the crowding out towards public care has positive effects on children's physical and mental health. Moreover, quality of care at home might have improved. If child care is more affordable, mothers might invest less but higher quality time into their children[17].

Second, the impact of the maximum fee rule reform might on child health might be induced by the reduction in child care prices. For families with children in public child care before the reform, any reduction in the child care prices serves as a positive income transfer. Black *et al*. (2014) have shown that lower child care prices act as a positive income shock to disposable income and improve child outcomes through this mechanism. Therefore, the maximum fee rule may directly lead to additional disposable income which parents can invest to buy more child quality.

To sum up, our findings draw the following picture linking the maximum fee rule reform and child health: the maximum fee rule is linked to physical health via a crowding out channel through which children from low income families particularly benefit. For mental health, an income channel additionally exists which mainly acts for children from median income families. Our findings therefore show that a large group of children benefits from a large-scale, universal child care reform in terms of health development, either directly through exposure to a suitable environment, or indirectly through potentially incresed parental investments.

5.5 Municipality-specific heterogeneity

As indicated by figure 1 there is a large variation in child care prices before the introduction of the maximum fee rule reform across municipalities. We assume that these different price levels generate a considerable heterogeneity

[16] We also considered labor supply and fertility as potential mechanisms. In line with the findings of Lundin *et al*. (2008) and Mörk *et al*. (2013) we do not find any promising effects.

[17] It has been shown in the medical literature, that day care services help to reduce the risks for internalizing problems for children of mothers with elevated depression symptoms (Herba *et al*. (2013)).

in physical and mental health effects of the reform.

Table 11: Heterogeneous effects of reform exposure on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
exposed	-0.28***	-0.032***	0.001	-0.025**	-0.034***	-0.025**	-0.009	-0.003	-0.015*
	(0.007)	(0.010)	(0.002)	(0.009)	(0.010)	(0.011)	(0.007)	(0.008)	(0.008)
muni : *med* × *exposed*	0.036***	0.022**	0.002	0.033***	0.022*	0.033***	0.020**	0.010	0.031***
	(0.009)	(0.011)	(0.002)	(0.014)	(0.012)	(0.014)	(0.009)	(0.009)	(0.009)
muni : *low* × *exposed*	0.035***	0.034***	0.004**	0.037***	0.037***	0.061***	0.033***	0.023***	0.027***
	(0.008)	(0.011)	(0.002)	(0.010)	(0.011)	(0.013)	(0.008)	(0.008)	(0.008)
					age 4–5				
exposed	-0.020***	-0.026***	-0.002	-0.029***	-0.033***	-0.054***	-0.015**	-0.025***	-0.015**
	(0.006)	(0.010)	(0.002)	(0.008)	(0.010)	(0.011)	(0.007)	(0.008)	(0.007)
muni : *med* × *exposed*	0.008	0.024*	0.001	0.003	0.001	0.020	-0.003	0.002	0.004
	(0.008)	(0.012)	(0.002)	(0.010)	(0.013)	(0.014)	(0.009)	(0.011)	(0.010)
muni : *low* × *exposed*	0.023***	0.024*	0.001	0.033***	0.024*	0.072***	0.015*	0.025**	0.023**
	(0.007)	(0.012)	(0.002)	(0.010)	(0.013)	(0.014)	(0.009)	(0.010)	(0.010)
					age 6–7				
exposed	-0.008	-0.026**	-0.002**	-0.012	-0.029**	-0.030**	-0.014	-0.013	-0.030***
	(0.007)	(0.011)	(0.001)	(0.009)	(0.012)	(0.013)	(0.009)	(0.010)	(0.010)
muni : *med* × *exposed*	0.001	0.001	0.002	0.000	0.003	-0.028	-0.002	0.011	0.002
	(0.009)	(0.014)	(0.002)	(0.012)	(0.016)	(0.017)	(0.012)	(0.013)	(0.013)
muni : *low* × *exposed*	0.002	0.011	0.001	0.009	0.017	0.019	0.008	0.001	0.031**
	(0.009)	(0.015)	(0.002)	(0.012)	(0.015)	(0.017)	(0.012)	(0.013)	(0.013)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality. $N_{\text{age 1-3}} : N(N \times T) = 24,204(91,514); N_{\text{age 4-5}} : N(N \times T) = 24,557(75,160); N_{\text{age 6-7}} : N(N \times T) = 22,061(68,296)$.

Table 12: Heterogeneous effects of reform exposure on children's psychological health and health behavior

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	-0.003	-0.006	-0.300***	-0.067	0.091**	-0.64**
	(0.003)	(0.004)	(0.105)	(0.133)	(0.041)	(0.035)
muni : *med* × *exposed*	-0.001	-0.001	0.436***	-0.268	-0.337***	0.107***
	(0.003)	(0.004)	(0.129)	(0.161)	(0.052)	(0.042)
muni : *low* × *exposed*	0.001	-0.001	0.601***	0.382**	0.375***	0.059
	(0.004)	(0.004)	(0.124)	(0.143)	(0.047)	(0.039)
			age 4–5			
exposed	0.006	0.007	-0.364***	-0.161	0.057***	0.062**
	(0.009)	(0.010)	(0.117)	(0.129)	(0.022)	(0.030)
muni : *med* × *exposed*	-0.002	-0.007	0.115	-0.180	-0.182***	-0.012
	(0.010)	(0.011)	(0.165)	(0.153)	(0.027)	(0.038)
muni : *low* × *exposed*	0.000	-0.004	0.389**	-0.028	-0.051**	-0.052
	(0.011)	(0.011)	(0.026)	(0.157)	(0.026)	(0.037)
			age 6–7			
exposed	-0.009	-0.020**	-0.153	-0.123	-0.115***	0.046
	(0.008)	(0.009)	(0.111)	(0.116)	(0.017)	(0.033)
muni : *med* × *exposed*	-0.004	-0.001	-0.038	-0.0352**	-0.004	-0.046
	(0.009)	(0.011)	(0.141)	(0.170)	(0.023)	(0.043)
muni : *low* × *exposed*	0.002	0.03	0.108	-0.107	-0.105***	-0.026
	(0.009)	(0.011)	(0.143)	(0.146)	(0.023)	(0.040)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality. $N_{\text{age 1-3}} : N(N \times T) = 24,204(91,514); N_{\text{age 4-5}} : N(N \times T) = 24,557(75,160); N_{\text{age 6-7}} : N(N \times T) = 22,061(68,296)$.

To explore this, we categorize municipalities into low, medium and large changes in child care prices, and interact the resulting three categories with the reform exposure dummy[18]. The reference group denotes children from

[18] We define municipalities with low fee changes to lie below the 25th percentile, with medium change between 25th and 75th percentile, and with high changes above 75th percentile of the distribution of price changes.

municipalities with relatively high changes in child care prices. This analysis allows us to assess if children from municipalities with high prices before the reform benefit relatively more from the maximum fee rule compared to their siblings. Table 11 presents the results on physical child health. For age 1–3, the main reform effect is negative and significantly different from zero for all types of infections, ear diseases and respiratory diseases. This suggests that exposed children from municipalities with relatively high changes in child care prices experience significantly lower probabilities of being diagnoses with such diseases. The pattern of heterogeneity is similar for other age groups, and the effects of reform exposure do not disappear.

Table 12 provides the results for mental health outcomes and health utilization. Similar to physical health outcomes, we find heterogeneity in the reform exposure effect with respect to the municipality group. Children from municipalities with high price changes are significantly better off in terms of mental health, they have more medical check ups, and they less often see a doctor at age 6–7 if they have been fully exposed to the reform. Moreover, being exposed to the reform significantly reduces the number of medical diagnoses among these children, irrespective of the age of diagnosis. The results show that there are considerable heterogeneity in the reform exposure effect displayed in table 4. Children from municipalities with high fees before the reform benefit most from the introduction of the maximum fee rule, while health gains are comparably lower for children from municipalities that experienced medium and low change in prices. The finding is also in line the presumed mechanisms discussed in section 5.4: Public child care least affordable in municipalities with high price changes. Thus the maximum fee rule reform may have led to a relatively strong crowding out of informal child care and to a relatively high increase in disposable income. As discussed in the previous section this generates large health gains for children from these regions[19].

5.6 Robustness checks

In the previous analysis we have considered families with at least two and a maximum of four children. However, the literature has detected a strong correlation between family size and child quality (Becker and Tomes (1976), Lundborg *et al*. (2013)). More siblings suggest that investments per child may be lower negatively influencing child health (see for instance Becker and Tomes (1976)). On the other hand, siblings may have a positive child health effect, since children are exposed to their siblings. We investigate the robustness of our main findings along this hypothesis by re-estimating equation (1) for families with two children only. Compared to the results in table 4, the found effects seem to be marginally stronger but are qualitatively very similar (see Appendix table A.1 and A.2). The reform effect seems not to depend on the number of siblings in the household, and is robust to changes in the sample composition.

One potential issue with the identification is that the reform does not only directly impact the exposed sibling's health, but also indirectly the other sibling's health. The direction of such a spillover however is ambiguous. On the

[19] We also explored heterogeneous effects across geographical areas. By splitting up the region of Skåne into an urban area (south-west) and a rural area (north-east), we find that children living in rural areas have better physical health if they have been fully exposed to the reform. Effects on mental health and health utilization however seem not to follow a geographical pattern. The corresponding results are available upon request.

one hand, the reduction in child care prices may lead to a reallocation of financial resources and to an increase the (health) investment for the non-affected sibling. In this case the estimated health effects of the reform may provide a lower bound estimate. On the other hand, there may be a spillover effect from the younger sibling's health to the older sibling's health. For instance, the presence of a younger sibling at age two being affected by the reform may negatively influence the health of the older sibling at age five, possibly changing the subsequent health path. Then, by comparing both siblings' health at age five and later, the positive health effect of the reform might also be driven an unobserved, negative spillover effect on the older sibling's health. The positive and direct impact of the maximum fee rule reform on child health might be overestimated. To show that the estimated effects of reform exposure are not likely driven by spillovers or redistribution within households, we provide two sensitivity checks. First, we re-estimate the relationship between the reform exposure and child health by including all children and without family fixed effects. Second, we estimate the reform exposure effect for single children only (see tables A.3 and A.4, A.5 and A.6 in the Appendix). The results without family fixed effects and for all children differ quantitatively from the estimated coefficients obtained from the sibling design estimates. However, while the coefficients in tables A.3 and A.4 are smaller than those presented in the main tables, the qualitative interpretation remains largely unchanged. Tables A.5 and A.6 provide us with the corresponding results for the sample of single children. Even though most of the physical health effects are not significantly different from zero at age 6–7, they still have a negative sign. In addition, mental health effects remain strongly negative, indicating that single children strongly benefit from the maximum fee rule reform in terms of their mental health.

Despite spillover effects, birth order might play a role for our findings. A number of studies has investigated the effect of birth order on children's development and education. While Garces *et al*. (2002) do not find any differences between the oldest and younger siblings in the effect of Head Start, Black *et al*. (2005) show that birth order rather than family size reveals causes high differences in later educational outcomes. In an analysis of infant health effects on child health, Oreopoulos *et al*. (2008) do not find significant differences in their results when controlling for sibling's birth order. To investigate the robustness of our results, we run a specification in which birth order fixed effects are included. As indicated by tables A.7 and A.8, accounting for birth order does not change our baseline findings in significant ways. Thus, the birth order of the sibling does not confound the overall exposure effect of the maximum fee rule reform. [20]

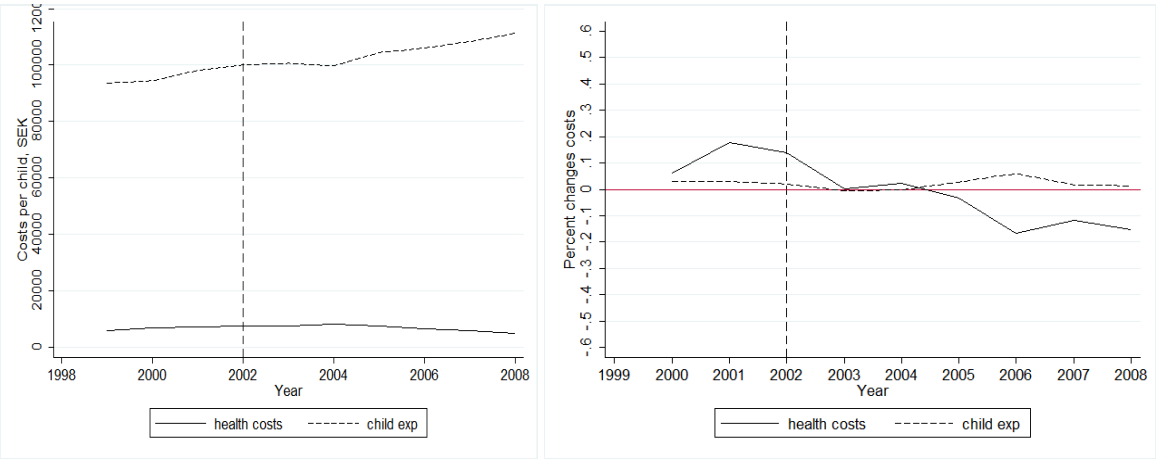
We finally change the level of clustering the standard errors from the household level to the municipality×year level to address potential issues with grouped error terms. As Betrand *et al*. (2004) state such a specification yields valid standard errors if health development between exposed and non-exposed siblings is the same in the absence of the maximum fee rule reform. Based on this assumption, tables A.9 and A.10 illustrate the findings. Clearly, changing the level of clustering only marginally affects the baseline coefficients[21].

[20] We also estimated the effect of being the younger child on child health in a sample of siblings that were all not affected by the maximum fee rule reform. Birth order mostly has a negative effect on children's health or is neutral for all age groups. This indicates that birth order does not play a major role in our setting.

[21] We also changed the clustering level to the municipality level. The results remain unchanged. The results are available upon request.

5.7 Public child care expenditures and health costs

We finally would like to investigate the effectiveness of the maximum fee rule reform for child health costs. The results of our main analysis strongly support the assumption that children that have been fully affected by the reform are physically and mentally healthier at the same age. In addition, these children have a lower total number of annual doctor visits than their counterparts. This suggests that the average health costs per child should be lower after the reform has taken place than in the years before. At the same year, however, the implementation of the maximum fee rule reform may have increased the municipalities' expenditures. We investigate the potential health cost-effectiveness of the maximum fee rule reform comparing the changes in health costs and child care expenditures per child on the municipality level. Information on health costs per child and municipality are derived from the administrative outpatient and inpatient data for the region of Skaåne. They contain all costs being generated by any medical contact. The child care expenditures are defined as the sum of all costs per child in a municipality including costs for facilities and staff.



(a) annual health costs & child care costs

(b) annual growth rate in health costs & child care costs

Figure 3: Development health costs and child care costs, per child

The left figure of figure3 shows the trend in overall costs for child health and child care[22]. There is a large differences in the predicted cost levels of the quantities: Municipality expenditures for child care are very high, ranging between 90.0000 and 112.000 SEK/a. Health costs are on a much lower level. They are between 5.000 and 8.000 SEK/a. While health costs seem to be on a constant level, child expenditure increase over time. The right figure of figure 2 plots annual percent changes of both costs, shedding more light on their development. Child expenditures annually increase by about 3% in the years before the reform, but remain almost unchanged in the

[22] figure 3 shows predicted values from a regression of health costs and child care expenditures, respectively, on the reform dummy, fractions of population for age 1-3,4-5,6-15,16-19,65+, a measure of population density, the fraction of low educated, poor children, foreigners, the local income tax base, the total municipalities expenditures, child care staff, municipality fixed effects, and a linear time trend. All costs are deflated to the 2010 level. We also checked the development of local tax rates, finding no changes over time and due to the reform.

immediate years after the reform. From 2005, costs seem to increase again by up to 7%. This can be explained by the fact, that each municipality received a grant from the state government to keep the level of child care quality and to implement the maximum fee rule reform. It has been shown by Hanes *et al*. (2009) that the grant significantly improves the situation of the municipalities. Child health costs steadily increase by up to 20% in the years before the maximum fee rule reform was implemented. However, the accumulation of health costs starts to decrease after the reform and turns into negative after 2004. In 2006 health costs are almost 20% lower than their pre-annual level. Local health costs per child decrease over time which supports the findings on lower rates of annual medical visits and fewer medical diagnosis per year. We expect that the long-term savings in health costs per child as adult may even be higher.

6 Conclusion

One major goal of universal preschool reforms throughout the world is to positively impact children's physical, cognitive and non-cognitive development. This paper presents evidence on how a major universal reform of the Swedish child care system has influenced physical and mental health development, and health utilization during early childhood. We show that particularly children from low income families are benefit from full reform exposure in terms of physical and mental health, being driven by a crowding out of informal care arrangements towards public child care. Moreover, we show that the drop in child care prices exhibit positive long term effect on mental child development, mostly for children from medium income households.

Our paper adds to the literature of child health development. According to the theory of health production, such positive health returns may persist into adolescence and adulthood and and yield as cross fertilizer for cognitive and non-cognitive child development (see Case *et al*. (2005), Currie *et al*. (2010) , Almond and Currie (2011), Bartling *et al*. (2012)). Our study thus may be a first step towards understanding how health develops throughout childhood and how universal high-quality, highly subsidized preschool influences the path of health production.

From a policy point of view our findings suggest that reducing child care fees is an effective tool to influence child health. Lower child care fee does have positive health effects for children from medium or high income families, devlivering income for additional child quality investments. In addition, such a policy makes child care more accessable to those children whose parents could not afford public formal child care otherwise. Thus, a policy of low priced universal child care indirectly targets children from disadvantaged background, having a very positive influence on their physical and mental health. Here it is worth to note that Sweden provides public child care of very high quality. This might not be the case in other countries. Thus one should be careful with generalizing our findings.

Finally, the results have shown that the reduction in child care fees leads to decreasing child health costs. This raises expectations about the long-term decrease in health from in adulthood. Unfortunately, our data do not allow us to track children into adult age in order to analyze long-term health development, and effects on other economic outcomes. However, if child health is a strong predictor of adult health, as shown for instance by Smith (2009) and

Conti *et al*. (2010), we expect them to perform better economically, suggesting financial benefits for the Swedish social system. Analyzing these long term effects leaves much scope for future research.

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7 Appendix

Table A.1: Effects of reform exposure on children's physical health, two sibling households

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
exposed	-0.003	-0.015*	0.003*	0.000	-0.016*	0.005	0.011*	0.007
	(0.005)	(0.008)	(0.002)	(0.007)	(0.009)	(0.00)	(0.006)	(0.007)
N×T	45,792	45,792	45,792	45,792	45,792	45,792	45,792	45,792
N	10,612	10,612	10,612	10,612	10,612	10,612	10,612	10,612
				age 4–5				
exposed	-0.011***	-0.025***	-0.003**	-0.017***	-0.031***	-0.029***	-0.009	-0.017***
	(0.005)	(0.008)	(0.001)	(0.006)	(0.009)	(0.009)	(0.006)	(0.006)
N×T	42,793	42,793	42,793	42,793	42,793	42,793	42,793	42,793
N	13,804	13,804	13,804	13,804	13,804	13,804	13,804	13,804
				age 6–7				
exposed	-0.0011**	-0.025***	-0.001	-0.017**	-0.028***	-0.029***	-0.009	-0.028***
	(0.005)	(0.009)	(0.001)	(0.007)	(0.009)	(0.010)	(0.007)	(0.008)
N×T	39,949	39,949	39,949	39,949	39,949	39,949	39,949	39,949
N	11,756	11,756	11,756	11,756	11,756	11,756	11,756	11,756

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.2: Effects of reform exposure on children's psychological health and health behavior, two sibling households

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
exposed	-0.003	-0.007**	-0.078**	0.044	-0.050
	(0.002)	(0.003)	(0.039)	(0.060)	(0.089)
N×T	45,792	45,792	45,792	45,792	45,792
N	10,612	10,612	10,612	10,612	10,612
			age 4–5		
exposed	-0.002	-0.003	-0.021	-0.229**	-0.091
	(0.007)	(0.007)	(0.018)	(0.091)	(0.094)
N×T	42,793	42,793	42,793	42,793	42,793
N	13,804	13,804	13,804	13,804	13,804
			age 6–7		
exposed	-0.012**	-0.015**	-0.076***	-0.088	-0.155*
	(0.005)	(0.006)	(0.014)	(0.074)	(0.084)
N×T	39,949	39,949	39,949	39,949	39,949
N	11,756	11,756	11,756	11,756	11,756

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.3: Effects of reform exposure on children's physical health, all children without family FE

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
exposed	-0.001	-0.009*	0.001*	0.001	-0.009*	-0.001	0.006*	0.005
	(0.003)	(0.005)	(0.001)	(0.004)	(0.005)	(0.006)	(0.003)	(0.004)
N	132,702	132,702	132,702	132,702	132,702	132,702	132,702	132,702
				age 4–5				
exposed	-0.006*	-0.009*	-0.002*	-0.008**	-0.012**	-0.020***	-0.011***	-0.011***
	(0.003)	(0.005)	(0.001)	(0.004)	(0.057)	(0.006)	(0.003)	(0.004)
N	106,790	106,790	106,790	106,790	106,790	106,790	106,790	106,790
				age 6–7				
exposed	-0.004	-0.006	-0.001	-0.007**	-0.007*	-0.023***	-0.007**	-0.009**
	(0.003)	(0.004)	(0.001)	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)
N	98,546	98,546	98,546	98,546	98,546	98,546	98,546	98,546

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; Individual regression with random effects controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.4: Effects of reform exposure on children's psychological health and health behavior, all children without family FE

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	-0.001	-0.001	-0.060	0.072	0.063***	-0.077***
	(0.001)	(0.002)	(0.055)	(0.074)	(0.023)	(0.021)
N	132,702	132,702	132,702	132,702	132,702	132,702
			age 4–5			
exposed	-0.004	-0.005	-0.167***	-0.212***	-0.046***	0.031**
	(0.004)	(0.004)	(0.060)	(0.067)	(0.010)	(0.015)
N	106,790	106,790	106,790	106,790	106,790	106,790
			age 6–7			
exposed	-0.010***	-0.012***	-0.072	-0.224***	-0.069***	0.031**
	(0.003)	(0.003)	(0.053)	(0.053)	(0.007)	(0.013)
N	98,546	98,546	98,546	98,546	98,546	98,546

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; Individual regression with random effects controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.5: Effects of reform exposure on children's physical health, single children households

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
					age 1–3			
exposed	-0.002	-0.011	0.010	-0.010	-0.010	-0.014	0.004	0.010
	(0.008)	(0.011)	(0.010)	(0.011)	(0.011)	(0.013)	(0.008)	(0.008)
N	33,624	33,624	33,624	33,624	33,6244	33,624	33,624	33,624
					age 4–5			
exposed	-0.005	-0.003	-0.001	-0.013	-0.001	-0.033**	-0.024***	-0.020**
	(0.007)	(0.011)	(0.002)	(0.009)	(0.012)	(0.013)	(0.009)	(0.009)
N	28,055	28,055	28,055	28,055	28,055	28,055	28,055	28,055
					age 6–7			
exposed	0.001	0.000	0.000	-0.002	-0.002	-0.019	-0.014*	-0.005
	(0.006)	(0.010)	(0.002)	(0.007)	(0.008)	(0.012)	(0.007)	(0.008)
N	27,576	27,576	27,576	27,576	27,576	27,576	27,576	27,576

standard errors are clustered on the individual level; *** p<0.01, ** p<0.05, * p<0.1; Individual regression with random effects controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, child moved, log birth weight, unemployment rate and population density in municipality.

Table A.6: Effects of reform exposure on children's psychological health and health behavior, single children households

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	0.003	0.003	0.040	0.317*	0.172***	-0.131***
	(0.003)	(0.003)	(0.116)	(0.180)	(0.058)	(0.049)
N	33,624	33,624	33,624	33,624	33,6244	33,624
			age 4–5			
exposed	-0.013	-0.015	-0.140	-0.181	-0.020	-0.013
	(0.009)	(0.009)	(0.130)	(0.153)	(0.024)	(0.037)
N	28,055	28,055	28,055	28,055	28,055	28,055
			age 6–7			
exposed	-0.016***	-0.013*	-0.143	-0.208	-0.038**	0.054*
	(0.006)	(0.007)	(0.107)	(0.132)	(0.016)	(0.031)
N	27,576	27,576	27,576	27,576	27,576	27,576

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; Individual regression with random effects controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, child moved, log birth weight, unemployment rate and population density in municipality.

Table A.7: Effects of reform exposure on children's physical health, with birth order FE

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
exposed	-0.005	-0.014*	0.002	-0.002	-0.014*	0.008	0.009*	0.004
	(0.005)	(0.007)	(0.001)	(0.006)	(0.008)	(0.008)	(0.005)	(0.006)
N×T	66,807	66,807	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866	13,866	13,866
				age 4–5				
exposed	-0.009**	-0.018**	-0.003**	-0.016***	-0.024***	-0.022***	-0.010*	-0.015***
	(0.004)	(0.007)	(0.001)	(0.006)	(0.007)	(0.008)	(0.005)	(0.005)
N×T	60,745	60,745	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423	17,423	17,423
				age 6–7				
exposed	-0.009**	-0.022***	-0.001	-0.009	-0.021***	-0.031***	-0.012**	-0.017***
	(0.004)	(0.007)	(0.001)	(0.006)	(0.008)	(0.009)	(0.006)	(0.006)
N×T	55,848	55,848	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for birth order fixed effects, a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.8: Effects of reform exposure on children's psychological health and health behavior, birth order FE

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	-0.003	-0.007**	0.048	-0.005	-0.053	-0.011
	(0.002)	(0.003)	(0.086)	(0.101)	(0.034)	(0.026)
N×T	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866
			age 4–5			
exposed	0.004	0.003	-0.183*	-0.231**	-0.023	0.039*
	(0.006)	(0.006)	(0.098)	(0.103)	(0.014)	(0.021)
N×T	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423
			age 6–7			
exposed	-0.009**	-0.016***	-0.120	-0.275***	-0.075***	0.021
	(0.004)	(0.005)	(0.074)	(0.091)	(0.012)	(0.021)
N×T	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control birth order fixed effects, a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.9: Effects of reform exposure on children's phzsical health, s.e. clustered on municipality×year level

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	other diseases
				age 1–3				
exposed	-0.005	-0.014	0.002*	-0.002	-0.014	0.008	0.009*	0.004
	(0.007)	(0.011)	(0.001)	(0.008)	(0.011)	(0.014)	(0.005)	(0.006)
N×T	66,807	66,807	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866	13,866	13,866
				age 4–5				
exposed	-0.009*	-0.018*	-0.003***	-0.016**	-0.024**	-0.022*	-0.010**	-0.015***
	(0.005)	(0.010)	(0.001)	(0.007)	(0.010)	(0.012)	(0.005)	(0.005)
N×T	60,745	60,745	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423	17,423	17,423
				age 6–7				
exposed	-0.009**	-0.022***	-0.001	-0.008*	-0.021***	-0.031***	-0.012**	-0.017***
	(0.004)	(0.006)	(0.001)	(0.005)	(0.006)	(0.009)	(0.005)	(0.005)
N×T	55,848	55,848	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the municipality×year level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.

Table A.10: Effects of reform exposure on children's psychological health and health behavior, s.e. clustered on municipality×year level

	developmental impairments	psychological all	diagnoses per year	visits per year	preventive visits	acute visits
			age 1–3			
exposed	-0.003	-0.007**	0.049	-0.008	-0.054	-0.011
	(0.002)	(0.003)	(0.106)	(0.237)	(0.207)	(0.041)
N×T	66,807	66,807	66,807	66,807	66,807	66,807
N	13,866	13,866	13,866	13,866	13,866	13,866
			age 4–5			
exposed	0.004	0.003	-0.184*	-0.233***	-0.024	0.039
	(0.005)	(0.005)	(0.105)	(0.075)	(0.057)	(0.028)
N×T	60,745	60,745	60,745	60,745	60,745	60,745
N	17,423	17,423	17,423	17,423	17,423	17,423
			age 6–7			
exposed	-0.009**	-0.015***	-0.123**	-0.277***	-0.075**	0.021
	(0.004)	(0.005)	(0.061)	(0.066)	(0.031)	(0.019)
N×T	55,848	55,848	55,848	55,848	55,848	55,848
N	14,958	14,958	14,958	14,958	14,958	14,958

standard errors are clustered on the municipality×year level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, number of older siblings, child moved, log birth weight, twins, unemployment rate and population density in municipality.