Costs of Daycare, Complementarities, and Heterogeneous Productivity of Parenting Time in Child Skill Formation

Tímea Laura Molnár
Central European University and IZA*

September 10, 2024

Abstract

I study how parents' perceptions of the technology of child skill formation shape their responses to a shock to the opportunity cost of their time in parenting. I show that when daycare price fell in Québec in 1997, parents bought more child goods (daycare, books) and allocated more time to their children, and high-educated parents increased their parenting time even more. For explanation, I build a new model of parents' time allocation, wherein productivity of parenting time (PPT) depends on parents' schooling, innate parenting ability, and mental health. My structural estimates reveal that parents perceive parenting time and goods as complements in child skill formation, and high-educated perceive their PPT as greater. If PPT is unaltered when daycare price falls, skills are predicted to increase more for high-educated parents' children, where most of the increase stems from more parenting—and not daycare—time. Thus, complementarity magnifies the role of policy, and greater PPT of high-educated exacerbates inequality and widens early childhood skill gaps.

A previous draft was circulated under the title: *'How Do Mothers Manage? Universal Daycare, Child Skill Formation, and the Parental Time–Education Puzzle.'*

First draft circulated: October 2016. This draft: September 2024.

*Central European University (Austria, Department of Economics and Business) and IZA; molnartl@ceu.edu.

This paper is a revised version of the first chapter of my PhD Dissertation, defended at the Vancouver School of Economics (VSE UBC) in 2017. I thank my PhD advisors at the VSE UBC—Kevin Milligan, Nicole Fortin, and Joshua Gottlieb—for their continuous guidance and invaluable advice. I thank Matilde Bombardini, Irene Botosaru, Pedro Carneiro, Patrick Francois, Giovanni Gallipoli, David Green, Florian Hoffmann, Hiro Kasahara, Gábor Kézdi, Miklós Koren, Mats Köster, Fabian Lange, Adam Lavecchia, Thomas Lemieux, Chris Muris, Adlai Newson, Marit Rehavi, Daniel Shack, Michéle Tertilt, Andrea Weber, Jonathan Zhang, and especially Botond Kőszegi, Kristóf Madarász, Vadim Marmer, and Ádám Szeidl, for insightful discussions and suggestions, and workshop, conference, and seminar participants for helpful comments. I also thank the seminar audience at the Human Capital and Economic Opportunity Global Working Group (HCEO) at the University of Chicago, and James J. Heckman, Steven Durlauf, and Robert Dugger, for selecting my PhD dissertation for the HCEO Dissertation Award in 2018. Cheryl Fu, Lee Grenon, Wendy Kei, and Danielle Forest provided invaluable help with the NLSCY, Census, LFS, SHS, and GSS data, and Jiaqi Zou provided excellent professional language editing help. Part of the analysis was conducted at the Québec Interuniversity Centre for Social Statistics (QICSS), which is part of the Canadian Research Data Centre Network (CRDCN). The services provided by the QICSS are made possible by the financial or in-kind support of the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), the Canada Foundation for Innovation (CFI), Statistics Canada, the Fonds de recherche du Québec, and the Québec universities. The views expressed in this paper are mine, and not necessarily those of the HCEO, the CRDCN, the QICSS, or their partners. All remaining errors are solely mine.

1 Introduction

Early childhood development is crucially influenced by parents' active involvement, but juggling work with parenting duties is challenging for most. Many policies target mothers' labor market (re)integration, such as subsidizing childcare costs and expanding childcare availability, either for some targeted groups of parents, or universally for all. While the impacts of such policies on parents' labor supply and children's development are well-studied, much less is known about how they affect parents' time with their children. Parents' perceptions of some key features of child skill formation are also poorly understood; *e.g.*, of whether parenting time complements goods bought on the market and if more educated parents' time is more productive in it. A better understanding of the extent to which such perceptions shape parents' responses to the introduction of universal childcare subsidies and expansions, however, could help anticipate their behavior in other policy contexts (*e.g.*, under mandatory childcare or cash transfers), and may shed light on the mixed evidence on how universal childcare affects child development—for which "*a tighter link between theory, econometric methods and data is essential*" (Duncan et al., 2022).

In this paper, I show new reduced-form evidence on parents' responses to cheaper daycare, using a universal policy in Québec in 1997: (1) parents allocate more time to their children and much less to housework, while spending more on goods that enhance child development, and on goods which save them time in housework; and (2) high-educated parents increase their parenting time more. (1) may be surprising, as both mothers and children spend less time at home due to cheaper daycare, and (2) may be surprising, as high-educated tend to have higher opportunity cost of time in non-work activities.

To explain my reduced-form findings, I develop a new model of parents' time allocation based on parents' beliefs of how their choices affect their children's skill formation. In my model, cheaper daycare makes parents wealthier and – not only daycare, but any other – market goods cheaper relative to time investments. Then, (1) is explained if parents perceive their time and goods bought for home production (*e.g.*, domestic help) as substitutes, but perceive their time and goods bought for their children's development (*e.g.*, daycare and books/toys, that I refer to as 'child market goods') as complements. Such complementarity captures that the returns of child market goods in skill formation are higher if the parents are present when the child uses them, and conversely, that the returns of parenting time are higher if there are toys to play with, books to read from, or daycare experiences to discuss.

To explain (2), I allow for several model parameters to depend on parental education, including the 'productivity of parenting time' (hereinafter, PPT)—captured with a multiplier on parents' time investments in child skill formation, of which higher values indicate a more enriching developmental environment, with, *e.g.*, more child-directed speech and parents' greater vocabulary. I assume that PPT depends on parents' education levels, their mental health, and their unobserved innate parenting ability and efforts. Through the lens of my model, if parents' time and child market goods are complements, high-educated parents' stronger time response can be explained if they believe that their parenting time is sufficiently more productive in child skill formation to offset their higher wage.

My novel approach to include parents' mental health as a determinant of PPT captures the simple fact that mentally stable parents are more able to be present with and to pay attention to their children, and to respond to them in a mindful, caring and emphatic way. I show that incorporating mental health

(captured by depression score) is required to avoid an omitted variable bias as it is also correlated with education, and to identify the extent to which parents perceive their PPT to depend on their education levels. I am the first one to estimate a positive relationship between PPT and education.

Using parents' optimal choices and exogenous daycare price variation, I estimate my model's key structural parameters, which confirm that in child skill formation, (i) parents perceive parenting time and child market goods as complements, and (ii) high-educated perceive their parenting time as more productive. I demonstrate my estimates' crucial policy implications *via* simulations: complementarity magnifies the role of policy, as it implies that parents increase both daycare and parenting times after daycare price falls; and, if PPT is fixed, child human capital increases more for children of high-educated parents, due to their larger parenting time increase, exacerbating inequality and widening skill gaps.

In what follows, in Section 2, I present the institutional background. In 1997, the Québec government granted universal, non-means-tested access to publicly-provided regulated care in daycare centres, for children aged 0-4, at a price of only $5 per day (while the median full-time price in daycare centres was $22 per day before 1997[1]), and expanded childcare coverage. The policy changed the financial incentives slightly more for richer parents, but in terms of accessing reliable and higher-quality daycare, low-educated and poorer parents benefited more, as they likely faced capacity constraints before 1997.

In Section 3, I present my new reduced-form findings, using two-way fixed effects as in previous studies for comparability (*e.g.*, Baker et al., 2008; Kottelenberg and Lehrer, 2017), looking at parents with children aged 0-4 in two-parent households in Québec *vs.* the rest of Canada, before and after 1997. I use data from the first seven waves of the National Longitudinal Survey of Children and Youth (NLSCY), the 1996/2001/2006 waves of the Census, the 1994–2006 cycles of the Labor Force Survey (LFS), and the 1986/1992/1996–2009 cycles of the publicly available Survey of Household Spending (SHS). I first confirm existing results on increased daycare use and maternal labor supply, and highlight that relative to their baseline, high- and low-educated families increase their daycare use to the same extent. I then show new results that (1) parents allocate more time to their children and drastically less time to home production, while spending more on child market goods, and (2) high-educated parents increase their parenting time more than low-educated parents do (by two *vs.* one hour per week).[2] I also show that parents increase spending on dining out, hiring domestic help and laundry services.

In Section 4, I present my new model, in which parents derive utility from child human capital, home production goods, and leisure goods—all of which are produced from inputs of time and goods bought on the market ('market goods'), with a Constant Elasticity of Substitution (CES) technology. Parents use daycare while working, thus their hourly wage net of the hourly daycare price is the opportunity cost of their time in non-work activities. I extend the classic time allocation framework of Becker (1965), by allowing for time and market goods to be differentially substitutable in child skill formation *vs.* in home production. Such an extension is key, as it enables the model to explain finding (1) as follows: cheaper daycare makes parents wealthier and any of the market goods less expensive relative to time investments. Then, due to positive income and substitution effects, parents demand

[1] Friendly, Martha, Jane Beach, and Michelle Turiano (2002), "Early Childhood Education and Care in Canada 2001," Childcare Resource and Research Unit, University of Toronto, Table 18; available here.

[2] To provide perspective, if high- and low-educated parents allocated this additional time on reading to their children 20 minutes per day, their children's Peabody Individual Achievement Test (PIAT) reading score at ages 5–9 is predicted to increase by 0.48 and 0.24 standard deviations, respectively (based on Price and Kalil (2019)).

more of any of the market goods, whether child-skill-enhancing or home-production-related, and substitute their time away from activities where they believe time is substitutable with market goods (in home production), to activities where time complements market goods (in child skill formation).

To explain finding (2), I introduce heterogeneity by education in the PPT, which is key because modelling high- and low-educated parents on wage differentials alone is insufficient to explain (2)—the intuition is that higher-wage parents' parenting time is more expensive, thus they increase it to a smaller extent, when daycare becomes cheaper. My model can explain (2) if high-educated parents believe that their parenting time is sufficiently more productive in child skill formation to offset their higher wage—the intuition is that, if inputs are complements, the greater the parents' PPT the greater the return on a given increase in child market goods that can be harvested with the increased time investments. But, allowing high-educated parents to have a stronger preference for child human capital and children with higher initial human capital would also induce them to increase their parenting time more—I account for these other sources of heterogeneity, too, to avoid their misattribution to PPT.

In Section 5, I present the identification and estimation of the structural parameters, on (i) the complementarity between parenting time and child market goods and (ii) the extent of high-educated parents' PPT advantage in child skill formation. Identification is solely from parents' choices, thus my estimates are parents' perceptions of those parameters. Intuitively, (i) is identified from the fact that parents increase both parenting time and child market goods when daycare becomes cheaper, and (ii) is identified from variation in parenting time relative to child market goods, by education. Formally, identification requires unobserved innate parenting ability and effort to be unrelated to parents' education, their mental health, and the 1997 Québec policy change, and the latter should strongly affect the daycare price. My CES substitution parameter estimate between parenting time and market goods in child skill formation is around -2.7 (s.e. 1.5), indicating strong complementarity. I find that high-educated parents perceive their PPT to be higher than low-educated perceive theirs.

In Section 6, I perform policy simulations and counterfactuals. I assume that child human capital is produced from parenting time and daycare time investments, and (i) I verify that, with the estimated structural parameters and *fixed PPT* and other parameters, but with actual daycare changes as in the 1997 Québec policy context, my model replicates findings (1)–(2). (ii) I show that in explaining (2), the PPT channel is quantitatively important and its role is roughly the same as the role of initial child human capital. (iii) I predict skill gaps after daycare price falls: if PPT is unaltered, the level of child human capital of high-educated (low-educated) parents' children increases by 16 (12) percent, widening the gap (whereas a targeted policy would decrease the gap by 10 percentage points). (iv) I decompose the predicted increase in child skills into a *direct* channel ($\frac{1}{3}$) *via* increased daycare time and an *indirect* channel ($\frac{2}{3}$) *via* increased parenting time, implying that complementarity magnifies the role of such a daycare policy. (v) I show that my model, with its structural estimates, replicates previous findings of this policy's negative effects on child outcomes (*e.g.*, Baker et al., 2008), if parents' mental health and thus their *PPT deteriorated* when daycare price fell—but if parents were not perfectly foreseeing such changes, and chose their time responses to cheaper daycare as if their PPT was fixed.

Finally, in Section 7, I show reduced-form effects of cheaper daycare by mothers' predicted propensity to work in the absence of cheap daycare, shedding light on previous negative findings and adding to the heterogeneity analysis of Kottelenberg and Lehrer (2017). I find that the worsened parental mental

health outcomes (captured by depression score), parenting outcomes (captured by hostility and aversity scores), and child outcomes (captured by aggression and anxiety scores) are driven by mothers who are likely to work even if daycare was more expensive, and who work even more as daycare price falls, likely experiencing more stress and time pressure. The outcomes of—especially high-educated—mothers who would be drawn (back) into the labor market by cheaper daycare actually do not worsen.

I contribute to three strands of literature. First, I add new reduced-form evidence on parents' time allocation responses to universal childcare policies on which evidence is scarce, even though impacts on parents' labor supply and children's development are well-studied,[3] and it is well-established that both the quantity and the quality of parenting time are crucial for child development.[4] Exceptions are Cascio and Schanzenbach (2013), Attanasio et al. (2020) and Carneiro and Ginja (2016), which study parents' market good and time investment responses to high-quality universal pre-school expansion, an early childhood RCT, and to permanent/transitory income shocks, respectively.[5] Compared to them, I study a daycare price decrease that changes parents' opportunity cost of time in parenting, I identify two key features of child skill formation that drives parents' responses—complementarity between parenting time and child market goods, and heterogeneity in PPT—and I decompose the predicted increase in child skills into the channels *via* increased daycare time *vs. via* increased parenting time. In my model, I also connect these two sets of evidence, and I am the first to highlight a key interaction when daycare price falls: under complementarity, parents with higher PPT will increase their parenting time more.

Second, I add to the literature on the technology of child skill formation, within the economics of parenting and child development,[6] to understand how parents' perceptions of child skill formation shape their responses to a shock to the opportunity cost of their time – *e.g.*, when daycare price falls. Subsequent work by Caucutt et al. (2023) uses the same framework for studying parents' intra-temporal decision problem, and besides Abbott (2022) and Moschini (2023), also estimates the degree of intra-temporal complementarity between parenting time and various market-based child goods.[7] Compared to them, I focus on complementarity between all child market goods (not only home-based and not only daycare) and parenting time. Also, my identification strategy relies on more transparent and exogenous variation – in which complementarity is identified from parents increasing daycare use, expenditures on child goods, *and* parenting time, when daycare price falls – and produces a stronger complementarity estimate that is essential for correctly accounting for parenting time impacts of daycare price policies.[8]

[3] For evidence on maternal labor supply *see*, among others, Bauernschuster and Schlotter (2015), Berlinski and Galiani (2007), Gelbach (2002), Baker et al. (2008), Lefebvre and Merrigan (2008), Lundin et al. (2008), Havnes and Mogstad (2011a), Black et al. (2014), Fitzpatrick (2010), Blau and Tekin (2007), Cascio, 2015, and Loken et al. (2018). For evidence on child development *see*, among others, Herbst and Tekin (2010), Baker et al. (2008), Kottelenberg and Lehrer (2013), Datta Gupta and Simonsen (2010), Berlinski et al. (2009a), Berlinski et al. (2009b), Magnuson et al. (2007), Cornelissen et al. (2017), Havnes and Mogstad (2011b), Havnes and Mogstad (2015), Baker (2011), Cascio (2015), Carneiro and Ginja (2014), Chetty et al. (2011), Heckman et al. (2010), and Currie and Almond (2011) for a review.

[4] Price and Kalil (2019), Kalb and van Ours (2014), Hale et al. (2011), Del Bono et al. (2016), Carneiro et al. (2015).

[5] This paper is also related—through changing opportunity cost of time—to the literature on the effect of tax changes on mothers' time allocation (*e.g.*, Gelber and Mitchell, 2012; Lochner and Bastian, 2022; Agostinelli and Sorrenti, 2021).

[6] *See*, among others, Almlund et al. (2011), Borghans et al. (2008), Cunha and Heckman (2008), Del Boca et al. (2014), Doepke and Zilibotti (2017), Doepke et al. (2019), Heckman et al. (2006), Heckman and Cunha (2007), Heckman et al. (2013), Heckman and Mosso (2014), Kosse et al. (2020) and Weinberg (2001).

[7] Caucutt et al. (2023) estimates the degree of complementarity between parenting time and *home-based* child market goods, and between home- and market-based child investments (such as childcare), Moschini (2023) between daycare time and parenting time, and Abbott (2022) between parenting time and selected child goods expenditures (not daycare).

[8] In Section 5.2 I discuss extensively the exact ways in which my identification strategy improves on theirs.

In recent studies, much attention is given to the quality of parenting time and the parent–child interactions (Cobb-Clark et al., 2019; Kim et al., 2018; Seror, 2022), and to the heterogeneity in PPT. Compared to Seror (2022) and Chaparro et al. (2020), which both observe that parenting takes (mental) effort, I explicitly include parents' mental health as one determinant of PPT. Differently from the approach of Brilli (2022), Caucutt et al. (2023), Del Bono et al. (2016), and Chaparro et al. (2020), but following my model's implications for identification, I condition on parents' mental health when estimating how (perceived) PPT depends on education, and I am the first one to estimate a positive relationship between them. Consistently with my estimates, Cunha et al. (2022) finds that poor mothers have lower subjective expectations about the returns to their parenting time, elicited by showing mothers hypothetical investment scenarios and asking their expected level of child human capital. Differently from them, I estimate parameters of PPT from parents' actual investment behavior.

Third, I add to the literature on early childhood skill gaps,[9] in particular on parental investments as a key source of gap widening.[10] My comprehensive theoretical model of parents' time allocation can explain why high-educated parents spend more time with their children (Guryan et al., 2008; Falk et al., 2021; Hill and Stafford, 1974; Leibowitz, 1974).[11] I show that high-educated perceiving their parenting time as more productive in child skill formation is a key mechanism behind their larger parenting time increase after daycare price falls, and that PPT depends on mental health. These results are crucial as heterogeneous responses shape skill gaps, and have equality-of-opportunity implications for whether cheaper daycare should be targeted to "level the playing field" or be universal. Also, mental health directly affects to what extent parents are able to be present with their children, including being warm, attentive, patient, and responsive, and thus may be an additional target of early childhood policies.

2 Institutional Background and Available Policy Evidence

2.1 The Québec Daycare Policy (1997)

To enhance mothers' labor force participation, child development, and equality of opportunity, the government of Québec in Canada granted universal access to centre-based or home-based government-provided, regulated, institutional daycare in daycare centres and nurseries, for children aged 4 and under, at an out-of-pocket price of $5 per day in 1997. Access was universal, irrespective of the parents' labor market status, and without entry requirements or means-testing. The phase-in was gradual by age: all four-year-olds in 1997 were exposed to the policy, and in the three consecutive years, exposure was extended to three-, two-, and zero-to-one-year-old children, respectively.

[9] There is evidence of significant skill and health gaps between the children of high- and low-educated parents, which widen as children become older; *see, e.g.*, Fryer and Levitt (2004), Fryer and Levitt (2006), Fryer and Levitt (2013), Cunha et al. (2006), Carneiro et al. (2005), Case et al. (2002), and Currie and Stabile (2003). Although the literature on these gaps often uses the label 'early childhood,' the majority of evidence relies on children above age 5. In ***Appendix C***, I test the behavioral gap, measured by hyperactivity, in the first 5 years of life, which is generally considered the 'critical period' in child development. I find that the gap widens most around age 3, and that bedtime reading, maternal mental health, and positive parenting practices are stronger transmission mechanisms than daycare time or maternal work.

[10] According to Heckman and Cunha (2007), a binding family income constraint in early childhood leads to under-investment in skills, and variation in parental environment and initial endowment are key factors of widening skill gaps.

[11] Falk et al. (2021) estimate heterogeneity by socio-economic status in overall investments, not specific to time.

There were quantity and quality improvements, as well as operational reforms associated with the policy change. On the quantity side, approximately 65,000 extra regulated daycare spaces were opened between 1998 and 2001, and an additional 90,000 were added through 2007 (Lefebvre and Merrigan, 2008). Baker et al. (2008) notes that the transition to the new system around 1997 was not without frictions, citing media suggesting a queue of 35,000 children initially. Using novel data on regional daycare coverage within Québec, Montpetit et al. (2023) shows that local childcare capacity was driving increasing daycare use, suggesting that capacity constraints were important before 1997.

On the quality side, those observable quality measures improved that are of primary importance to parents, such as daycare teachers' educational attainment and qualifications, and—particularly to high-status parents—the staff-to-child ratios (Gordon et al., 2010; Drange and Ronning, 2020): in 2000, the educational requirements for staff of the regulated daycare institutions were substantially increased and their wages were scheduled to increase by 35-40 percent over a four-year period. I document these substantial increases in observable daycare quality measures in ***Appendix A*** for those working in NAICS code "6244 – Child Day Care Services," in Québec and the rest of Canada, in 1994–2006. The maximum facility size was increased by holding staff-to-child ratios fixed (except for 4-5-year-old children), and parental involvement in the board of directors increased (Baker et al., 2008).

Data about daycare quality is scarce, but Japel et al. (2005) presents evidence suggesting that it did not deteriorate in centres. After 1997, more centre- and home-based daycares offered good-quality services than regulated and unregulated for-profit daycares; centre- and home-based daycares excelled in quality of interactions between staff and children, and less in the quality of educational activities.[12]

As Baker et al. (2008) documents, this policy increased the financial incentives somewhat more for richer families, as direct daycare subsidies for poorer families and a refundable tax credit, depending on family income, were already available before the policy implementation. Parents with a subsidized daycare spot were not eligible for further direct subsidies or provincial tax credit for daycare expenses, but remained eligible for a federal deduction. Prior to 1997, low-income families were eligible for direct daycare subsidies, and single women typically qualified for substantial subsidies. Two important institutional reasons—the substantial subsidies for singles prior to the implementation of the 1997 Québec Daycare Policy, and the contemporaneous policy change of the Québec Family Allowance[13]—led Baker et al. (2008) to exclude single parents from their analysis, and I follow their sample selection.

The policy granted access to reliable and higher quality daycare more so for poorer families. Lefebvre and Merrigan (2008) highlights that liquidity-constrained poor families, struggling with accessing reliable high-quality daycare before 1997, particularly benefited from the new daycare regime, and emphasizes key features of the new daycare centres—longer childcare hours, being licensed and regulated—which many parents preferred over the relative-provided, non-licensed daycare.

[12] To assess a potential income/education gradient in daycare quality, Japel et al. (2005) finds that, after 1997, children received services of similar average quality irrespective of their family background in centre-based daycare, but that regulated and unregulated home-based daycare and for-profit daycare attended by disadvantaged children were of lower quality. They also suggest that, post-1997, high-educated parents' children attended higher-quality daycare, but, due to lack of data, they cannot empirically assess the change in education gradient from before 1997 to after 1997.

[13] Baker et al. (2008) reviews family tax credits in Canada, including the two types of income-dependent refundable tax credits (the Canada Child Tax Benefit and the National Child Benefit Supplement), and the Québec Family Allowance. They graph the trend in effective subsidy of daycare prices by province, for parents in two-parent families and for single mothers, with at least one child below age five, and show that the impact of the policy is 50 percent smaller for the latter.

2.2 Existing Evidence on the Québec Daycare Policy (1997)

The first set of empirical evidence is clear: the policy increased maternal labor supply and daycare use; *e.g.*, Baker et al. (2008) uses waves 1-2 and 4-5 of the NLSCY and shows that two-parent families eligible for cheaper daycare increased daycare use primarily in institutional care (in daycare centres) and in other's home (provided by a licensed non-relative), and increased maternal labor supply, where the share of working mothers using daycare increased the most. Lefebvre and Merrigan (2008) uses the Survey of Labor and Income Dynamics (SLID) for 1993-2002, and finds that the policy had a positive effect on the short-term labor supply of mothers (on both margins and earnings), who had at least one child between ages one and five. They find significant effects for mothers with more than a high school diploma. Lefebvre et al. (2009) finds that the policy had long-term labor supply effects for mothers, who benefited from the program when their child was six-years-old or younger; their results are driven by less educated mothers. Haeck et al. (2015) substantiates that the policy had lasting effects on the number of children in daycare (on both margins), and on mothers' labor force participation.

Montpetit et al. (2023) finds that the policy impacts on daycare use and mothers' labor supply for low-educated (but not for high-educated) families were driven by families who lived in areas in Québec in which the daycare expansion was substantial (relative to the pre-policy daycare coverage). These results suggest that for high-educated families the main incentive for take-up was the price reduction, while for low-educated families, access to institutional daycare was prohibitively binding prior to 1997.

The second set of empirical evidence is controversial. Baker et al. (2008) shows that for two-parent families, program eligibility led to worse child outcomes and parenting practices, on average, and to more severe maternal depression and family dysfunctioning. Kottelenberg and Lehrer (2013) substantiates these results by including more treated cohorts who received the treatment when daycare centres were better established and experienced, and supply constraints were less binding. They also use policy eligibility as an IV for daycare attendance, and find that the negative impacts seem to be driven by families who were only induced to increase daycare use by the policy change (*i.e.*, for the compliers). Baker et al. (2019) shows that the non-cognitive deficits persisted into the children's teenage years, and that cohorts with increased daycare access had higher crime rates, worse self-reported health, and lower life satisfaction (but, without an impact on cognitive scores). Haeck et al. (2018) and Haeck et al. (2022) find that the negative effects persisted to at least school age. Kottelenberg and Lehrer (2017) finds that parents in complier two-parent households with four-year-old children increased their propensity to read to their children daily, while those with children younger than four-years-old decreased their propensity to read to their children daily. Their findings suggest that developmental outcomes for disadvantaged single-parent households are actually positive. Brodeur and Connolly (2013) finds more stress, more sleep problems, and worse work-life balance for low-educated mothers eligible for subsidized daycare.

Compared to the existing findings, I show evidence for two-parent households on the impact of program eligibility on a new set of time-use outcomes, in parenting and in home production. Complementing the parenting quality time outcomes in Kottelenberg and Lehrer (2017), I confirm that program eligibility decreases parents' propensity to read to their children daily, but I show that it increases reading at the other end of the distribution (reading at least once per week).[14]

[14] In their Tables 5–7, Kottelenberg and Lehrer (2017) shows that two-parent families with children aged 0–3 decrease

3 New Reduced-Form Effects of Cheaper Daycare on Parents' Time

3.1 The Difference-in-Differences (DiD) Empirical Strategy

To assess the overall and differential impacts of the 1997 Québec Daycare Policy, I use a DiD identification strategy and estimate Intent-to-Treat (ITT) effects—the effects of program eligibility—in a repeated cross-section data structure, using two-way fixed effects, without staggered introduction by age. To compare my estimates directly with those in the extensive literature on this policy, I implement the same DiD specification as in many other studies, such as Baker et al. (2008, 2019), Kottelenberg and Lehrer (2013, 2017), and Lefebvre and Merrigan (2008). Extending the model with an interaction term, I also test whether the policy impact differs for high-educated families, by differentiating families where the mother pursued some post-secondary or college-level studies (whether completed or not) from those where the mother obtained a high-school degree but not a post-secondary degree.

Using data on parents with children aged 0–4 in two-parent families, I estimate models (1)–(2):

$$Y_i = \alpha_0 + \alpha_1 \text{policy}_{tp} + \alpha_2 C_i + \alpha_3 U_i + \alpha'_{4t} + \alpha'_{5p} + \alpha'_{6a} + \alpha'_7 X_i + \nu_i, \tag{1}$$

$$\begin{aligned} Y_i \quad &= \beta_0 + \beta_1 \text{policy}_{tp} + \beta_2 \text{policy}_{tp} \cdot \text{high-educ}_i + \beta_3 C_i + \beta_4 U_i \\ &\quad + \beta'_{5t} + \beta'_{6p} + \beta'_{7a} + \beta'_{8te} + \beta'_{9pe} + \beta'_{10} X_i + \varepsilon_i, \end{aligned} \tag{2}$$

where i indexes households, t time, p provinces, and a child age. The variable of interest, policy_{tp} is the interaction between the child being born in an exposed cohort (alternatively, the family being observed in the post-policy period after 1997)—hence the index t—and residing in Québec—hence the index p. C indicates that the mother obtained some post-secondary, college-level studies below the bachelor's level (including attending a CEGEP or a community college, and obtaining a trade/technical degree) in addition to a high school degree. U indicates that the mother obtained at least a bachelor's degree. In what follows, I categorize families as high-educated (high-educ = 1) if the mother has taken at least some post-secondary studies (either $C = 1$ or $U = 1$). α_{4t} and β_{5t} correspond to a full set of year (or wave) dummies; α_{5p} and β_{6p} correspond to a full set of province dummies; α_{6a} and β_{7a} correspond to a full set of child age dummies; β_{8te} corresponds to a vector of education-specific dummies, separately for the pre- and post-period, and β_{9pe} to a vector of education-specific dummies for Québec and the rest of Canada. X includes the age and gender composition of the household children, household size, and the parents' age. I determine the household's education solely by the mother's education.[15]

In models (1)–(2), α_1 captures the Intent-to-Treat (ITT) effect of cheaper daycare for all families (*i.e.*, the conditional difference in Y between Québec and the rest of Canada, pre- and post-1997), β_1 captures the ITT effect for low-educated parents, and β_2 captures to what extent that differs for high-educated. Standard errors are clustered at the province-post level, accounting for the within-province correlation of errors over time, allowing for a structural break in the temporal correlation at 1997.[16]

reading to their children daily, driven by children in the first quintile of the Motor and Social Development score.

[15] Results are robust to controlling for the father's education, or determining the household's education based on both parents' education. These results are available upon request from the Research Data Centre of Statistics Canada.

[16] The confidence intervals for the main estimates in Tables D10–D13 in ***Appendix D*** show that the standard errors are robust to the Wild-bootstrapping method of Cameron et al. (2008), accounting for small numbers of clusters.

3.2 Data and Measurement

I use Canadian data from: the first seven waves of the National Longitudinal Survey of Children and Youth (NLSCY), the 1996/2001/2006 waves of the Census, the 1994–2006 cycles of the Labor Force Survey (LFS), and the 1986/1992/1996–2009 cycles of the publicly available Survey of Household Spending (SHS, previously named Survey of Family Expenditures). I select children living in two-parent families under the age of five from the NLSCY, Census, and LFS (in which the unit of observation is an individual), and I select two-parent households with at least one child under age five from the SHS (in which the unit of observation is a family). The data structure is repeated cross-section for all.

As outcomes in the reduced-form analysis, the parental labor supply measures (from the NLSCY, Census, and LFS) include an indicator variable for being employed, and the actual hours worked. The binary daycare-use measures (from the NLSCY) indicate whether the child is in institutional care (*i.e.*, in daycare centres or in nursery), daycare in own home or in others' home, or in any care from the aforementioned options (*see* details in ***Appendix B***). There is no data on past choices of daycare mode.

The time-use outcome variables measured in the Census stem from the following questions which aim to capture household activities. Specifically, respondents were asked how many hours *in total* last week they spent on "*(a) doing unpaid housework, yard work or home maintenance for members of this household, or others? /Some examples include: preparing meals, washing the car, doing laundry, cutting the grass, shopping, household planning, etc./*" and "*...(b) looking after own children, without pay? /Some examples include: bathing or playing with young children, driving children to sports activities or helping them with homework, talking with children about their problems, etc./*," where the response is for all children in the household, and not specifically for the child(ren) under age five. Respondents could select one of the following options: i) none, ii) <5 hours, iii) 5–14 hours, iv) 15–29 hours, v) 30–59 hours, vi) >60 hours. Besides analyzing binary outcomes, I also form a continuous variable, measured by the midpoint of bins i)—vi). There exists Canadian time-use diary survey data, only for the post-policy period (1998, 2005, 2010), in which respondents put each minute of their time into mutually exclusive categories, indicating their primary focus of interest, which I use for assessing robustness.

Household expenditures (from the SHS) include food expenditures (all food/from store/from restaurant), expenditures on hiring domestic help, and expenditures on the child (daycare expenditures and expenditures on children's toys, games, and books). All aforementioned expenditures are expressed as a percentage of total expenditures. Households complete both a questionnaire for regular (*e.g.*, rent and electricity) and less frequent expenditures (*e.g.*, furniture and dwelling repairs) for a recall period of varying length (1/3/12 months); then, households complete an expenditures diary in which they record the expenditures of all household members for one week after the questionnaire.

Eligibility for the 1997 Québec Daycare Policy is defined as follows: in the NLSCY, no child below age five is eligible in waves 1–2 (1994 and 1996); in wave 3 (1998), three- and four-year-old children are eligible; and in later waves, all children are eligible. In the LFS, no child below age five is eligible before 1997; four-year-old children are eligible in 1997, three- and four-year-old children are eligible in 1998, two- to four-year-old children are eligible in 1999, and all children are eligible from 2000 on. In the Census and SHS, the pre-policy years are prior 1997 and the post-policy years are after 1997.

3.3 Identification

For the DiD model to provide a consistent estimator for the policy impact, the main requirement is that the counterfactual time trend in outcomes in Québec (*Que*) needs to be parallel to the observed time trend in the rest of Canada (*RoC*); *i.e.*, in the absence of the policy, the trends would have been parallel. Unfortunately, parental time-use data assessing pre-trends is unavailable, as there is only one period observed prior to 1997 in the Census. Reassuringly, Figure 1 shows that pre-trends in *Que* and *RoC* for mothers' employment rate and work hours are parallel or converging, and for institutional daycare use they diverge slightly before 1997, but then all diverge sharply once the policy is phased in.

Besides the aforementioned Figure 1 suggesting that the parallel trend assumption is defensible, Baker et al. (2008) provides evidence of no detectable differential trends for several important demographic and control variables in Québec, relative to the rest of Canada, and Kottelenberg and Lehrer (2013) documents similar trends for maternal labor supply and daycare use. To address any coincidental Québec-specific shocks, Baker et al. (2008) also demonstrates that (i) their estimates are robust to the inclusion of province-specific economic conditions, and (ii) there is no policy impact on older children who were never exposed to the policy and who did not have any younger siblings exposed.[17]

Importantly, I solely use a repeated cross-structure in every dataset. Even in the NLSCY, I only keep the first observation of every eventually-treated child, and they do not serve as a control individual in their not-yet-treated time periods. Therefore, concerns about dynamic treatment effects in a staggered design (*e.g.*, Goodman-Bacon, 2021; de Chaisemartin and D'Haultfoeuille, 2020, 2022) do not apply in this case. Also, for the main time-use datasets, the age-staggered policy design is not a concern, as all children are treated by 2001. While excluding years 1998–1999 in the NLSCY and LFS datasets could at least partially address any anticipation effects, keeping these years yields a more conservative estimate for daycare-use effects; the estimates of Kottelenberg and Lehrer (2017), which excludes these waves, are considerably larger than mine, as are the ones in Baker et al. (2008).[18]

3.4 Reduced-Form Estimates: Policy Impacts for All and by Education

In each of Tables 1 to 4, I present the reduced-form Intent-to-Treat (ITT) effects of cheaper daycare, stemming from the DiD models, for numerous outcomes. Table 1 confirms existing evidence on daycare use and maternal labor supply responses to decreasing daycare prices. Tables 2 to 4 show the empirical contributions of this paper on parental time use, parents' propensity to read to their children, and household expenditures on food, domestic help, daycare, and children's toys, books and games.

The first row of each table shows the outcome variables (in bold), and *Panel A* shows the estimates of the coefficients and standard errors on the policy and education variables from estimating models (1) and (2). The coefficient estimates on the interaction variable show whether the policy impact is significantly different for families where the mother has some post-secondary education or a university degree, compared to families where the mother has at most a high school degree. *Panel B* shows the

[17] I performed the same checks, and confirm the robustness of my estimates to these. Additionally, I confirm that (iii) there is no policy impact on food and domestic expenditures for households without children, as a placebo check. The results of (i), (ii), and (iii) are available upon request from the Research Data Centre (RDC) of Statistics Canada.

[18] The results of excluding NLSCY waves 3 and 4 are available upon request from the RDC of Statistics Canada.

weighted baseline means and the estimated policy impacts by education, to assess the size of the policy impact. Specifically, for each outcome variable, the first column shows the weighted baseline mean in the estimation sample for observations where $\text{policy}_{tp} = 0$, while the second column shows $\hat{\beta}_1 + \hat{\beta}_2$. The *p-values* in *Panel C* show whether the policy significantly affected high-educated families, in terms of the corresponding outcome variable; *i.e.*, they correspond to: $H_0 : \beta_1 + \beta_2 = 0$.[19]

3.4.1. Daycare Use on the Extensive Margin

Table 1 shows that, consistent with previous evidence and the policy aim, eligibility to the 1997 Québec Daycare Policy significantly increases daycare use in regulated (institutional) daycare and in any care by 18 and 13 percentage points (200 and 29 percent of the baseline mean), respectively (columns (1)–(2));[20] the policy impact is significantly larger for high-educated families in absolute terms, but not relative to their baseline mean (which is 247 and 190 percent for low- and high-educated families, respectively). The impact on daycare in any care is significantly larger for high-educated families but, relative to their baseline mean, it is approximately 29 percent for both (columns (3)–(4)).[21]

Importantly, eligibility to the 1997 Québec Daycare Policy has the same impact—relative to their baseline mean—on any daycare use for low- and high-educated families. This result suggests that even though the policy changed the financial incentives slightly more for richer families, the fact that poorer families faced capacity constraints *prior* to the policy (as discussed in Section 2.1) ultimately led both groups to take up the policy to the same extent. Thus, differential Intent-to-Treat (ITT) results can be attributed to the differential impact of the policy, as opposed to the differential uptake of the policy.

3.4.2. Maternal Labor Supply on the Extensive and Intensive Margins

Table 1 shows the policy impact on mothers' labor supply along the extensive margin, using data from the NLSCY (columns (5)–(6)).[22] A decrease in the daycare price significantly increases mothers' propensity to be employed by 7.6 percentage points (13 percent),[23,24] driven by high-educated mothers, both in absolute and relative terms. Low-educated mothers increase their labor supply by 4.2 percentage points (8.7 percent), while high-educated mothers increase it by 9 percentage points (13.5 percent). There are significant increases in mothers' hours worked by 1.2 hours on a base of 20 (columns (7)–(8)), using the LFS data (as the NLSCY does not record labor hours)),[25] driven by high-educated mothers.

[19] Figures E1, E2, and E3 show the estimated difference between Québec and the rest of Canada across the years.

[20] Table D1 shows that the policy decreased daycare use in own and in other's home by 3 and 2.4 percentage points (13 and 22 percent), respectively. Baker et al. (2008) uses waves 1-2 and 4-5 of the NLSCY and estimates the same model (1), finding a point estimate of 14 percentage points, which is very close to my estimate of 13.1 using waves 1-7. Kottelenberg and Lehrer (2013) uses waves 1-2 and 5-7, finding a point estimate of 19.6—this larger estimate can be understood in light of Figure 1: institutional daycare use rose the most between waves 3-5, and then between 6-7.

[21] On the intensive margin, Table D2 shows that cheaper daycare led to a significant 5.9-hour (49 percent) increase in time in daycare, while the fraction of children in daycare for at least 20 hours per week increased by 16 percentage points (59 percent). The policy impact on daycare hours is larger for high-educated families in absolute terms, but is not different relative to the baseline mean (44 and 50 percent increase in hours for low-and high-educated families). The estimated impacts translate to 45 (80) minutes more daycare per day for low-educated (high-educated) parents' children. Table D3 reveals that around 75 percent of the increase in (any) daycare use comes from working mothers, while primarily low-educated mothers increase their daycare use without working at the same time (by 4.9 percentage points).

[22] Table D4 in ***Appendix D*** confirms this result from the Census (*see* columns (1)–(2)).

[23] To compare with existing work, Baker et al. (2008), Kottelenberg and Lehrer (2013), and Lefebvre and Merrigan (2008) find a point estimate of 0.077, 0.110, and 0.073, respectively.

[24] Table D4 shows only a 1.3 percentage point increase, on a basis of 88 percent for fathers (*see* columns (5)–(6)).

[25] Respondents who work zero hours are included. Fathers' labor hours decrease only for those with a low-educated partner (by 1.9 hours per week (5 percent); *see* column (8) in Table D4).

3.4.3. Parental Time Use (Reading, Parenting, Home Production)

This section displays this paper's new reduced-form results: First, I show that parents eligible for cheaper daycare increase total time spent with their children, at the expense of time spent on home production. Then, I show parenting quality time outcomes that complement those of Kottelenberg and Lehrer (2017): I confirm their results that eligibility decreases parents' propensity to read to their children daily, and I add that it increases reading time at the lower end of the reading distribution.

Table 2 reveals that parents decrease their propensity to never read to their children by almost 3 percentage points (33 percent). Parents also increase their propensity to read once a week to their children by 2 percentage points (50 percent), and increase reading 2-3 times a week by 3.6 percentage points (18 percent), with the former response driven entirely by the high-educated. Reading daily to children decreases by 2.6 percentage points (3.9 percent), with no detectable education differences.

Table 3 shows the policy impact on parents' time allocation, as measured in the Canadian Census, which asks respondents to categorize their time use into one of six bins. In response to decreasing daycare prices, mothers increase their time spent with their children by 0.87 hours per week (1.94 percent, given a base of 44.8 hours, or 7.5 minutes per day), and the response is significantly larger for high-educated mothers (1.268 hours or 2.85 percent or 11 minutes per day). The same pattern holds for fathers; the corresponding impact is 0.72 hours (3 percent, or 6.2 minutes per day) for all, and 0.93 (0.44) for partners of high-(low-)educated mothers (8 and 3.8 minutes per day).[26] Mothers decrease their home production time by 2 hours per week (on a base of 30 hours), while fathers decrease theirs by 1 hour per week (on a base of 14 hours).[27] The increase in mothers' (fathers') parenting time is 133 (52) percent of the difference in the average parenting time of high- and low-educated families (0.6 and 1.33 in columns (1) and (5) in *Panel B*), thus the increase is substantial relative to the baseline difference. Overall, parents spend 1.5 hours per week more with their children after daycare price falls.

I make two remarks: first, it may be possible that stay-at-home mothers tend to conduct passive childcare and under-report parenting time, but their time with their children is more clearly delineated when they work and they are more likely to report it then. Two reassuring pieces of evidence make this scenario unlikely to drive the main time-use results: (i) The significantly positive coefficient estimate in Table 7 on the indicator variable for mothers who would be unlikely to work in absence of the policy ($\hat{\gamma}_3$) does not suggest that stay-at-home mothers would under-report parenting time before the policy. (ii) If I consider 1998 to be in the pre- and 2005 and 2010 in the post-policy period, then I also find in the GSS Time Use Diary[28]—in which respondents put each minute of their time into mutually

[26] Table D5 in ***Appendix D***, where the outcomes are dichotomous, reveals that mothers are significantly less likely to spend at most 15 hours (*see* column (3)), but more likely to spend at least 30 hours with their child (*see* column (7)), both by approximately 2 percentage points. These results are driven by high-educated mothers, among whom spending at most 15 hours with their children decreases by 15 percent, and spending at least 30 hours with their children increases by 8.5 percent. Among fathers, spending at most 15 hours per week with their child decreases by 2.7 percentage points, and spending 15-30 (31-60) hours per week with their child increases by 1.1 (1.9) percentage points (*see* Table D6). These results are also driven by high-educated mothers' partners (for whom the effects are -8, 5, and 11.8 percent, respectively).

[27] Table D7, where the outcomes are dichotomous, shows that mothers spending at most 15 hours per week on home production increases by 5.3 percentage points (18 percent), and spending 15-30 hours (31-60 hours) on home production decreases by 0.9 (2.8) percentage points (3.2 (11.8) percent). The latter decrease comes from high-educated mothers, and the differences across groups are not otherwise statistically significant. Similarly, fathers spending at most 15 hours increases by 3.6 percentage points on home production (5.2 percent), and spending 15-30 hours (31-60 hours) on home production decreases by 2.1 (1.1) percentage points (10 and 15 percent; *see* Table D8).

[28] Table D9 in ***Appendix D*** shows that, in the GSS, eligibility for cheaper daycare induces mothers to significantly

exclusive time-use categories indicating their primary focus of attention—that high-educated mothers and fathers increase their parenting time. Thus, measurement of time use does not drive my results for the high-educated (for low-educated, estimates are imprecise and inconclusive due to a small sample).

Second, although I am unable to empirically assess the possibility that parents spend more time with their children to compensate for a potential drop in the quality of the longer subsidized daycare time (and that high-educated parents' children may be better off when not in daycare but at home), Section 2.1 suggests that this is unlikely:[29] there is no evidence that the quality in daycare centres targeted by the policy deteriorated and observable quality measures that are of primary importance to high-educated parents actually improved in Québec. In my model I nevertheless explicitly include daycare quality, and allow for high-educated parents' time to be less substitutable with market goods (such as daycare time) in child skill formation, than how substitutable low-educated parents' time is.

3.4.4. Household Expenditures (Food, Children, Home Production)

The estimated policy impacts on household expenditures (per total) are in Table 4, in which every 2^{nd} and 3^{rd} column uses years in which data on parental education is available in the SHS.[30]

Columns (1)–(2) in *Panel A* of Table 4 show that, in response to cheaper daycare, eligible two-parent families significantly increase all food expenditures by 0.8-0.9 percentage points (7 percent). Expenditures on food from stores increase by 0.55 percentage points (5 percent; column (5)), while expenditures on dining out at restaurants increase relatively more (by 0.34 percentage points or 14 percent; column (8)). The increase in the share of food expenditures is significantly larger (in absolute and in relative terms) for low-educated families. The lower panel reveals that high-educated families—more likely to use regulated, more expensive daycare prior to 1997—save on daycare expenditures (by 28 percent), and low-educated families—more likely to use informal, even free daycare arrangements prior to 1997—increase their daycare expenditures (by 26 percent). The increase in expenditures on children's games and toys (by 18 percent) and domestic help (by 79 percent) do not differ by education.

Overall, my results are consistent with many pieces of empirical evidence in other policy contexts, first of all with the results of Cascio and Schanzenbach (2013), which finds that the expansion of high-quality universal pre-school in Georgia and Oklahoma induced low-educated mothers to increase time spent caring for or helping their children. But, they do not find any (robust) labor supply impacts for low-educated (high-educated) mothers. Thus, their results are less comparable with the ones from the 1997 Québec Daycare Policy that substantially and persistently increased mothers' labor supply.[31]

increase time spent with their children by 1.5 percentage points (on the base of 13 percent, or 22 minutes per day) (which comes from increasing time on playing with the children, putting them to bed, and helping/teaching/reprimanding – these results are available upon request), and is driven by high-educated mothers (who increase their parenting time by 2.28 percentage points, or 17 percent) and their partners (by 1.5 percentage points, or 22 percent). High-educated mothers also decrease time spent on home production ((4)). (These effects are significant at the 10 percent level.)

[29] It would be also inconsistent with Gensowski et al. (2024), which finds that only low-educated parents increase their time investments in response to a preschool quality intervention in Denmark (if their children attend low quality schools).

[30] In Figure E3 in ***Appendix E***, the estimated difference between Québec and the rest of Canada can be seen for households with and without children under age five, for general household expenditures, as a falsification test.

[31] My results are also consistent with evidence on tax changes, and changing opportunity cost of time in non-work activities; *e.g.*, Gelber and Mitchell (2012) finds that tax changes increase single mothers' work hours at the expense of home production and leisure—consistent with my findings—and report an insignificantly positive estimate for parenting time. They also find that expenditures on food prepared outside of (at home) increase (decrease), with an insignificantly positive estimate for hiring domestic services. Lochner and Bastian (2022) finds that the EITC expansion increases mothers' work hours and reduces time on home production, and that the reduction in parenting time does not come

4 A New Model of Parental Time Allocation

The aim of my model is twofold: to explain the reduced-form estimates, and to provide the estimation equations for the model's key structural parameters to perform policy simulations and counterfactuals. The source of the identifying variation in the reduced-form is the same as that in the structural parameter estimation, stemming from policy variation across provinces over time; but, while the reduced-form estimates suggest the signs of the structural parameters through the lens of the model (*e.g.*, complementarity between parenting time and market goods in child skill formation), the structural estimates reveal their magnitude (given some functional form assumptions outlined below), and allow simulations.

My new model of parental time allocation is inspired by the setup outlined in words by Guryan et al. (2008). I employ the following elements from them: households derive utility from a home production good, a leisure good, and their child's human capital,[32] which, as in Becker (1965), are produced from time and a market good, and, as in Aguiar and Hurst (2007), can be classified based on the elasticity of substitution between time and the market good in their production processes.

In my model, parents produce child human capital from parenting time and child market goods, according to a Constant Elasticity of Substitution (CES) production function. Thus, differently from Agostinelli and Sorrenti (2021), Attanasio et al. (2020), Brilli (2022), Del Boca et al. (2014) and Lee and Seshadri (2019),[33] but similarly to Caucutt et al. (2023), Abbott (2022) and Moschini (2023), I do not impose restrictions on the substitutability between inputs, but estimate the intra-temporal CES parameter in child skill formation. As time investments and expenditures for the same household are unobserved in multiple periods in my data, I abstract from the dynamic complementarity between inputs in different time periods (Cunha et al., 2010) that subsequent work by Caucutt et al. (2023) additionally considers, but separately identifies from the intra-temporal complementarity between parenting time and child market goods. I account for endowment effects (Todd and Wolpin, 2003), by allowing parents to invest based on their child's initial human capital (captured by the birth weight).[34]

My second key and novel feature is to model the productivity of parenting time (PPT) in child skill formation: I assume that PPT depends on parents' education levels, their mental health that determines to what extent they are able to be present with and pay attention to their children in a mindful and emphatic way, and innate parenting ability and effort that are uncorrelated with both. To focus on the dependence of PPT on education, I do not model parents' investments into their mental health or caring effort (differently from Seror (2022) and Chaparro et al. (2020)), but assume that parents treat their PPT as fixed—which, I confirm, is consistent with my data in this policy setting.

from child skill investment-related activities. Without looking at time allocation directly, Agostinelli and Sorrenti (2021) disentangles increased family income *vs.* maternal labor supply—and, as they presume, less time spent with children—due to the EITC expansion. Similar to my approach, they consider that more work may affect the quality of parenting time, but differently, they do not cut their sample based on mothers' propensity to work in absence of the EITC expansion.

[32] Guryan et al. (2008), without formalizing this setup, discusses how time allocations may change with parents' wages, but they do not investigate parents' time responses to a shock in the opportunity cost of their time in non-work activities. They suggest that such a framework can be extended by introducing heterogeneity in preferences or in time productivity.

[33] Del Boca et al. (2014) assumes that child quality in the next period is produced from the current level of child quality, parenting time, and child expenditures, using a Cobb-Douglas function, not allowing for complementarity, but allowing for dynamic child skill formation. Agostinelli and Sorrenti (2021) models the trade-off between market goods and time investments when child skills are produced from money, time, according to a linear function with perfect substitutability.

[34] Due to data limitations, I have to abstract from them, but I acknowledge that lack of information, social norms, or peer effects around how to spend time with children may also contribute to the observed differences by education.

4.1 The Setup of the Model and Its Solution for Estimating Structural Parameters

Consider a unitary household model that abstracts from fertility decisions and bargaining between parents. The household has one child and derives utility from three commodities—child human capital K, home production goods H, and leisure goods L—according to a Cobb-Douglas utility function:

$$U = \beta_K \log K + \beta_H \log H + \beta_L \log L. \tag{3}$$

Parents believe that commodities K, H, and L are produced from time T and market good X with (separate) CES production functions, where ρ is the substitution parameter between T and X:

$$K = \left(\left[(\gamma_K T_K)^{\rho_K} + X_K^{\rho_K} \right]^{\frac{1}{\rho_K}} \right)^{K_0} ;\; H = \left[(\gamma_H T_H)^{\rho_H} + X_H^{\rho_H} \right]^{\frac{1}{\rho_H}} ;\; L = \left[\gamma_L T_L^{\rho_L} + X_L^{\rho_L} \right]^{\frac{1}{\rho_L}}. \tag{4}$$

Negative values of ρ imply complementarity between inputs whereas values between 0 and 1 imply substitutability between inputs, with the Leontief, Cobb-Douglas, and perfect substitutes case being the limiting cases for $\rho = -\infty, \rho = 0$, and $\rho = 1$, respectively. T_K is parental time investment in child human capital production, and X_K includes non-parental childcare time purchased from the market (*e.g.*, subsidized daycare) and all other child goods (*e.g.*, toys, games, books).[35] The multiplier γ on the time input is called the 'time productivity parameter,'[36] and K_0 is initial child human capital.

High- and low-educated parents can differ in five aspects with respect to child human capital K:
— 1) In the productivity of parenting time (PPT) in child skill formation (γ_K), which depends on parents' years of schooling S, their mental health P, and (for the researcher) unobserved innate parenting ability and effort ε_γ. Parents believe that PPT is fixed and unrelated to their time allocation. Better mental health enables parents to mindfully pay attention to, be present with and care of their children.
— 2) In the preference parameter for child human capital (β_K), which depends on parents' years of schooling S, and (for the researcher) unobserved heterogeneity term ε_β.
— 3) In initial child human capital (K_0), that is a function of child birth weight W.
— 4) In the substitution parameter (ρ_K), so that high-educated parents' time may be less substitutable with daycare time and other child market goods than low-educated parents' time.[37]
— 5) High-educated parents can have higher wages and incomes, and thus afford more goods.

Formally, I make the following parametric assumptions for γ_K, β_K and K_0 in the model:

$$\gamma_K = \gamma_0 S^\delta P^\xi \varepsilon_\gamma ;\; \beta_K = \beta_0 S^\varphi \varepsilon_\beta ;\; K_0 = W^\varsigma. \tag{5}$$

The key structural parameters to-be-estimated are δ, which shows how γ_K depends on schooling, conditional on parents' mental health and innate parenting ability; φ, which shows how β_K depends on schooling, conditional on unobserved heterogeneity in preferences; and complementarity parameter ρ_K.

[35] T_H is home production time, and X_H includes market goods (*e.g.*, hired domestic help, laundry/cleaning services, purchased prepared meals). L is leisure experience, produced from X_L (*e.g.*, movie tickets, books) and leisure time T_L.

[36] The time productivity parameters (γ) are linked to parents' marginal product of time investment in the non-work production of the commodities (as in Gronau, 1977), but are not linked to parents' market productivity (wage).

[37] With this, I allow for the possibility that advantaged children may be better off when not in daycare but at home (Cornelissen et al., 2017)—despite that I do not formally model different modes of childcare, due to data limitations.

ξ and ς, respectively, show the extent to which γ_K depends on mental health, conditional on schooling and parenting ability, and the extent to which initial child human capital depends on birth weight.

The household decides about T and X for producing each of the commodities. The total household time for each of the time-use categories is produced from the time of the mother and the father. Child market goods are composed of (quality Q adjusted) daycare time D and all other child goods B. The household buys childcare D, at the price of m, while the parents work,[38] and also buys all other market goods at the price of 1. Mothers and fathers supply T_W^M and T_W^F amount of time in the labor market, and earn w^M and w^F for an hour of work, respectively, with no non-labor income.

Regarding the household's constraints, I assume that (i) parents use daycare during their average work hours, and that (ii) there is no overlap between time-use categories (*e.g.*, during home production, the child might be around the parents, but is not the primary focus of their attention). Note that (i) allows for the mother to not work, in which case daycare is paid solely by the father's labor income.

I derive in ***Appendix F*** and ***H*** that in optimum, the expression for the ratio of T_K^* and X_K^* is:

$$\frac{T_K^*}{X_K^*}(\equiv logY_i^A) = \left(\frac{\left(w^M - \frac{1}{2}m\right)\theta_K}{\alpha}\right)^{\frac{1}{\rho_K - 1}} \gamma_K^{\frac{\rho_K}{1-\rho_K}}, \text{ where } \theta_K = \left(\frac{w^F - \frac{1}{2}m}{w^M - \frac{1}{2}m}\right)^{0.5} \text{ and } \alpha = \left(\frac{m}{Q}\right)^{0.5}. \tag{6}$$

Similarly, I derive that the optimal share of child expenditures to potential household income I is:

$$\frac{X_K^*\alpha + T_K^{M*}\left(w^M - \frac{1}{2}m\right)}{I}(\equiv logY_i^B) = \bar{\beta}_0 S^{\varphi}\varepsilon_{\beta}K_0 \text{ (where } \bar{\beta}_0 \text{ is a constant).} \tag{7}$$

Then, using (5), one can arrive from (6) and (7) at two estimation equations in which the regression coefficients are non-linear functions of the structural parameters to-be-estimated (δ, φ, ρ_K, ξ and ς).

Two notes on the optimal Marshallian demands: first, an important feature of my model is that it does not incorporate childcare cost m as a fixed cost paid by the household if the parents are working, which would then be independent of their work time; rather, m is part of the parents' opportunity cost of time in non-work activities. This modelling decision allows my model to predict different responses to a change in m for parenting time and home production time, depending on the signs of ρ_K and ρ_H.

Second, even though my model abstracts from intra-household bargaining—due to unavailable data to identify relative bargaining strengths of parents—, to the extent that the optimal bargaining solution is characterized by within-household time allocation being proportional to relative wages as in (6), my model and the extended model with bargaining would not deliver substantially different predictions for complementarity and heterogeneity in PTT in child skill formation, my objects of interests.

4.2 Comparative Statics and Predictions of the Model

Now I address three questions: how the optimal cross-sectional choices of market goods and time depend on parental education; how optimal choices change in response to cheaper daycare; and how these responses to lower m depend on parental education. Importantly, parents assume that cheaper daycare does not affect their parenting time productivity parameter, γ_K. To simplify the exposition,

[38] Due to data limitations, I have to abstract from the decision to use free childcare provided by grandparents.

and without loss of generality, I consider the case where $w^M = w^F \equiv w$ (implying that $\theta_K = 1$) and in which the variation in the shadow price μ depends only on variation in income I.

I need to account for the following five channels operating simultaneously. First, all else equal or *ceteris paribus* (*c.p.*) (including γ_K, β_K, ρ_K, K_0), high-educated parents' wage (thus, their opportunity cost of time) is typically higher ("wage channel"). Second, *c.p.*, high-educated parents' time may (perceived to) be differentially productive in child skill formation ("time productivity, or PPT, channel"). Third, *c.p.*, high-educated parents' time may (perceived to) be differentially substitutable with market goods ("substitutability channel"). Fourth, *c.p.*, parents' preference for child human capital may differ across education groups ("preference channel"). Fifth, *c.p.*, high-educated parents typically have children with higher birth weight (higher initial level of child human capital, "birth weight channel").

In what follows, I decompose parents' choices into the above five channels by totally differentiating optimal choices, and sign the channels. This total differentiation is helpful when thinking about any reduced-form finding; the empirical estimates indicate which channels need to dominate, given the observed education gradient in the data. (The details of the derivation are in ***Appendix G***.)

4.2.1. The Dependence of Optimal Cross-Sectional Choices on Parental Education

I find that high-educated parents will spend more on child market goods through the channels of wage, time productivity (if $\rho_K < 0$), preference, and birth weight, but will spend less through the substitution channel. Given that the partial derivative with respect to w is positive, the model predicts that higher-wage parents will buy more of any of the market goods (whether child-skill-enhancing or home-production-related), irrespective of the sign of ρ. Then, high-educated parents will spend more time with their children through the channels of wage (if $\rho_K < 0$), substitution, preference, and birth weight, but will spend less through the time productivity channel (also, if $\rho_K < 0$).

The intuition behind the wage channel is that *c.p.,* higher-wage parents are more able to buy any of the market goods, and if inputs are complements (substitutes) in child skill formation (home production), they will spend more time (less time) with their children (on home production).

The time productivity channel, in general, is ambiguous: parents with higher PPT have a higher marginal product of time investments in child skill formation, but can also produce a given level of K in less time (*c.p.*); then, which channel dominates depends on the degree of substitutability between time and market goods in child skill formation. If inputs are substitutes, parents with higher PPT have an incentive to invest more parenting time and substitute out a larger portion of child market goods. If inputs are complements, parents with higher PPT have an incentive to buy more market goods (even if they invested more time, they would need to also buy more market goods to reap additional output).

4.2.2. Response to a Decrease in Daycare Price

As childcare becomes cheaper, the model predicts that parents (i) spend more on market goods (whether child-skill-enhancing or home-production-related), as their potential household income increases and time becomes relatively more expensive to market goods (*i.e.*, both the income and substitution effects are positive), (ii) spend more (less) time with their children (on home production) if time and market goods are complements (substitutes) in child skill formation (home production).

4.2.3. The Dependence of Optimal Responses to a Daycare Price Decrease on Education

In absolute terms, the model predicts that high-educated parents increase their demand for child market goods and their supply of parenting time more through the time productivity channel, if time and

market goods are complements in child skill formation. But, importantly, allowing for high-educated parents to have a stronger preference for child human capital and to have children with higher levels of initial child human capital would also induce them to increase their parenting time more. Thus, it is crucial to account for these two channels to avoid their misattribution to the channel of PPT. In sum, if high-educated parents increase their demand for child market goods and their supply of parenting time to a greater extent than low-educated parents when daycare is cheaper (in absolute values), these empirical facts indicate that the channels of time productivity, preference, and birth weight dominate the substitutability and wage channels (if parenting time and child market goods are complements).

The intuition behind a positive time productivity channel is as follows. To the extent that inputs are complements, the greater the parents' time productivity in child skill formation, the greater the return reaped from a given increase in child market goods (*e.g.*, daycare or books) with an increase in parenting time. At the same time, parents with higher wage have a higher opportunity cost of time that incentivizes them to increase parenting time to a smaller extent, leading to a negative wage channel.

A final remark on model predictions in this subsection: in absence of the PPT channel and under complementarity between parenting time and child market goods, the model predicts that high-educated parents increase the *logarithm* of their parenting time to a *lesser* extent through the wage and substitutability channels (the result of which is partly driven by the functional assumption of Cobb-Douglas utility, and the log-separability of β_j and K_0 in the Marshallian demands).[39] Yet, the results in *Panel B* of Table 3 do not confirm such a prediction, suggesting the presence of a PPT channel.

5 Identification and Estimation of the Structural Parameters

5.1 Expressing Structural Parameters from Parents' Optimal Choices

To build intuition, I start with identification of ρ_K for all, and then extend this simpler case below.

The first estimation equation for estimating structural parameters ρ_K (the substitution parameter between parenting time and market goods in producing child human capital), δ (which shows how PPT depends on parents' years of schooling), and ξ (which shows how PPT depends on parents' mental health, conditional on schooling) is derived from (6) in ***Appendix H***, using (5), and it is:

$$log\left(\frac{T^*_{Ki}}{X^*_{Ki}}\right) = \beta_{A0} + \beta_{AS} logS_i + \beta_{AP} log\bar{P}_i + \beta_A logE_i + \epsilon_{Ai}. \tag{8}$$

In (8), the outcome is the log-ratio of optimal child time and child market goods, and the regressors are $logE$, which is a non-linear function of parents' wages, daycare price, and daycare quality,[40] and

[39] Note that the Marshallian demands in this problem are almost identical to the the standard ones for Cobb-Douglas utility, except that here there is no direct price for the goods producing child human capital K, home production good H, and leisure good L, but an equilibrium price index is formed from the underlying input prices ($w - \frac{1}{2}m$ for T_K and 1 for X_K). Other than this difference, the demands are linear in the utility parameter β_j, initial child human capital K_0, and income, and the demand for the j-th good only depends on the input prices for the j-th good. If, for instance, instead of a Cobb-Douglas, a Stone-Geary utility function were used, the Marshallian demands would no longer be log-additive in the utility parameter, but additive in the "committed" amount on each good, and would depend on all prices. Thus, they would considerably lose from their tractability and simplicity, without delivering significantly more important insights.

[40] As derived in ***Appendix F, G,*** and ***H***, $logE_i = log\left(w_i^M - \frac{1}{2}m_i\right) + \frac{1}{2}log\left(\frac{w_i^F - \frac{1}{2}m_i}{w_i^M - \frac{1}{2}m_i}\right) - \frac{1}{2}log\left(\frac{m_i}{Q_i}\right)$.

the logarithms of parents' years of schooling S and mental health $\bar{P}$, which parents treat as fixed with respect to m; the error term ϵ_A contains the logarithm of unobserved parenting ability and effort (ε_γ). From the regression coefficient vector $\beta \equiv (\beta_{A0}, \beta_{AS}, \beta_{AP}, \beta_A)$, the vector of structural parameters is:

$$\left(\rho_K, \quad \delta, \quad \xi, \quad \gamma_0 \right) = \left(\frac{1+\beta_A}{\beta_A}, \quad \beta_{AS}\left(\frac{1-\beta_A}{\beta_A}\right), \quad \beta_{AP}\left(\frac{1-\beta_A}{\beta_A}\right), \quad e^{\beta_{A0}\left(\frac{1-\beta_A}{\beta_A}\right)} \right).$$

The second estimation equation for structural parameters φ (which shows how preference for child human capital depends on schooling, conditional on unobserved heterogeneity), and ς (which shows how initial child human capital depends on birth weight) is derived from (7), using (5), and it is:

$$logY_i^B = \bar{\beta}_0 + \varphi logS_i + \varsigma logW_i + \epsilon_{Bi}. \tag{9}$$

In (9), the outcome is the log-share of child expenditures on market goods and maternal child time, relative to potential household income I (on the left of (7)), W is child birth weight, and the error ϵ_B contains the logarithm of the unobserved heterogeneity in preference for child human capital (ε_β).

5.2 Identification of the Structural Parameters

I start with the identification requirements of vector β in (8), from which ρ_K, δ and ξ are identified. First, (the logarithm of) parents' schooling (S) and mental health (P) have to be weakly exogenous:

$$\textbf{ID1: (i) } E\left(logS_i \cdot \epsilon_{Ai}\right) = 0; \text{ (ii) } E\left(log\bar{P}_i \cdot \epsilon_{Ai}\right) = 0.$$

Empirical evidence in developmental psychology supports **ID1**. For (i), Carr and Pike (2012) do not find a significant relationship between between maternal education and scaffolding abilities (the latter capturing the extent to which parents are able to fine-tune their parenting style and instruction level to their children's actual skills and performance, proxying for innate parenting ability and effort).[41] For (ii), no difference is found in the positive/attentive nature of mother–infant interaction and parenting effort for mothers with anxiety (Murray et al., 2007; Murray et al., 2012; Weinberg et al., 2008; Kaitz et al., 2010) and depression *per se*, only when it is coupled with risk factors such as poverty or chronic health conditions (Weinberg, 2001; Campbell et al., 1997; Carter et al., 2001; Lovejoy et al., 2000).

A concern regarding endogeneity remains even if **ID1** is met: in (8), log$E$ is potentially endogenous, being a function of both parents' wages: it might happen that unobserved parenting ability and effort, though assumed to be unrelated to parental education $logS$ and mental health $log\bar{P}$, are related to parents' wage, hence to E, through some general ability (even conditional on $logS$ and $log\bar{P}$).

To overcome this source of endogeneity, I use a binary variable policy$_{tp}$ as an Instrumental Variable (IV), that takes the value of 1 if the household lives in Québec with the daycare policy in effect at time t, and 0 otherwise. Then, the policy change needs to be strongly related to a non-linear function of parents' wages, daycare price and quality, $logE$ (conditional on $logS$ and $logP$), but be unrelated to

[41] Scaffolding is *"the process whereby mothers' instruction is contingent on the child's performance. Thus, when the task is beyond the child's current attainment, help is increased; this reduces task complexity and allows the child to focus on what is within his or her capability. As the child's competency for the task grows, the mother can gradually withdraw her help, enabling the child to perform more and more of the task independently.* (Carr and Pike (2012), p. 543).

innate parenting ability and effort ϵ_A. The corresponding 1^{st}-stage eq. for the endogenous $logE$ is:

$$logE_i = \tau_0 + \tau_1 \text{policy}_{tp} + \tau_2 logS_i + \tau_3 log\bar{P}_i + \eta_{1i}. \tag{10}$$

Then, formally, the further identification requirements are:

$$\begin{aligned} \textbf{ID2 (IV strength):} \quad & \tau_1 \neq 0 \\ \textbf{ID3 (IV exogeneity):} \quad & E\left(\text{policy}_{tp} \cdot \epsilon_{Ai}\right) = 0. \end{aligned}$$

ID2 is testable and is expected to hold since the 1997 daycare policy in Québec drastically decreased the price of daycare; thus *policy* is related to $logE$ through m – which also means that the IV estimator uses the variation in $logE$ only through changing daycare price m due to the policy change. **ID3** requires urelatedness of the policy from innate parenting ability and effort, which I consider an innocuous one. Given the policy change did not affect $logS$ and $log\bar{P}$, the exclusion restriction is defendable; *i.e.*, that the policy change is related to various outcomes only through $logE$, and not through other channels.

Under **ID1**—**ID3**, β is identified, and the IV estimator, $\hat{\beta}_n$, is consistent for β (*see* ***Appendix H*** for the proof). Intuitively, ρ_K, the substitution parameter between parenting time and market goods in child skill formation, is identified from parents increasing both when daycare becomes cheaper (which was shown in Section 3.4), and δ is identified from variation in parenting time relative to child market goods by parents' education (conditional on wages, daycare price and quality, and mental health).

β is identified from variation in parents' actual choices, thus the structural parameter estimates capture parents' perceptions of those. For instance, a positive $\hat{\delta}$ would indicate that parents perceive their PPT to increase in schooling, which is supported by empirical evidence: *e.g.*, Gould et al. (2020) finds that the correlation in intergenerational education is stronger with the parent who spends more time with the child, and high-educated parents choose activities that best fit their child's actual developmental needs (Kalil et al., 2012), use more advanced speech (Hart and Risley, 1995; Hoff, 2003), and use more child-directed speech more often (Rowe, 2008; Weisleder and Fernald, 2013).[42] Parents may or may not be aware of this evidence, and ultimately their perceptions drive their behavior.

My identification strategy relies on more transparent and exogenous variation than existing studies that also estimate the intra-temporal complementarity between parenting time and market goods. Compared to Caucutt et al. (2023), which instruments parents' wages with predicted wages and US state and time dummies, I instrument with an exogenous daycare price policy change. Compared to Moschini (2023), which includes family fixed effects that take care of the unobserved time-invariant component of the productivity of parenting time (whereas Abbott (2022) assumes the time-varying component away), my identification strategy, using policy variation, addresses any type of unobserved heterogeneity in PPT. Time-varying unobserved heterogeneity likely lead to underestimation of the

[42] Kalil et al. (2012) finds that high-educated mothers spend most of their time reading to their children and problem-solving with their child during their preschool years, but shift to managing their children's lives in middle school, as required by changing demands towards their children. Hoff (2003) shows that hearing more advanced speech—measured by number/length of utterances, word tokens/types, and topic-continuing replies—at home is a key reason behind the better language skills of the children of high-educated parents. Weisleder and Fernald (2013) finds large variation in child-directed speech by parental education, and that children exposed to child-directed speech are more efficient in processing familiar words in real time, and have larger expressive vocabularies by the age of two.

degree of complementarity,[43] and thus to underprediction of parents' time responses to cheaper daycare.

Existing studies, such as Caucutt et al. (2023), Chaparro et al. (2020) and Brilli (2022), do not control for parents' mental health when estimating to what extent PPT depends on parents' education. My framework makes it clear why controlling for mental health $\bar{P}$ in (8) is crucial to identify β_A and ultimately δ, which shows how PPT depends on parents' years of schooling. If $\bar{P}$ is omitted from (8), it will remain in the error term, and since S and $\bar{P}$ are positively related and their coefficients is expected to have the same sign, β_A will be overestimated; then, if $\rho_K < 0$, δ will be underestimated.

To identify the substitution parameter between time and market goods in child skill formation, ρ_K, separately for low- and high-educated parents, I include an interaction variable between the endogenous $logE$ and an indicator variable 'high-educ' into (8), from which $\rho_K^L = \frac{1+\beta_{AL}}{\beta_{AL}}$ and $\rho_K^H = \frac{1+\beta_{AL}+\beta_{AH}}{\beta_{AL}+\beta_{AH}}$:

$$log\left(\frac{T_{Ki}^*}{X_{Ki}^*}\right) = \tilde{\beta}_{A0} + \tilde{\beta}_{AL} logE_i + \tilde{\beta}_{AH} logE_i \cdot \text{high-educ}_i + \tilde{\beta}_{AS} logS_i + \tilde{\beta}_{AP} log\bar{P}_i + \epsilon_{Ai}, \tag{11}$$

with a corresponding 1^{st}-stage equation for the endogenous $logE$:

$$logE_i = \pi_0 + \pi_1 \text{policy}_{tp} + \pi_2 \text{policy}_{tp} \cdot \text{high-educ}_i + \pi_3 logS_i + \pi_4 log\bar{P}_i + \eta_{2i}. \tag{12}$$

Let $\tilde{\beta}$ be the coefficient vector in (11), and let **ID2'** be the **IV strength** ID requirement for (12):

ID2' (IV strength): $\pi_1 \neq 0$ and $\pi_1 + \pi_2 \neq 0$.

As shown in ***Appendix H***, under **ID1**, **ID2'** and **ID3**, $\tilde{\beta}$ is identified (and the IV estimator, $\hat{\tilde{\beta}}_n$, is consistent for $\tilde{\beta}$), from which the identification of the structural parameters $(\rho_K^L, \rho_K^H, \delta, \xi, \gamma_0)$ follows.

Finally, identification of the regression coefficients in (9)—and thus, the structural parameters φ and ς—requires parents' schooling (S) and their children's birthweight (W) to be weakly exogenous:

ID4: (i) $E\left(logS_i \cdot \epsilon_{Bi}\right) = 0$ and (ii) $E\left(logW_i \cdot \epsilon_{Bi}\right) = 0$.

ID4 is met if (the logarithm of) unobserved heterogeneity in parents' preference for child human capital, ε_β, is the residual left after partialling out (the logarithm of) parents' schooling levels S and their children's birthweight W (or, in other words, projecting $logS$ and $logW$ onto preferences). The theoretical and empirical literature on *in utero* investments provides support for **ID4**; *e.g.*, Del Bono et al. (2012) models birth weight as the result of genetic and fetal-specific factors, as well as prenatal investments (maternal smoking or antenatal care). In their framework, prenatal investments and ultimately birth outcomes are influenced by parental preferences, resource constraints, the technology of skill formation, and parents' beliefs about child endowments (which parents observe only at birth). To the extent that differences in child birth weight, together with parents' schooling levels, fully reflect different preferences for child human capital, any remaining unobserved heterogeneity in parental

[43] Applying the Frisch-Waugh-Lovell Theorem to (15) of Moschini (2023), if parents' wages positively correlate with time-varying unobserved heterogeneity in parenting productivity (in the error term), and higher-wage parents spend less time with their children (relative to child goods), holding productivity fixed, the estimator for β_1 is downward biased.

preferences for child human capital will be unrelated to both. Also, Bharadwaj and Lakdawala (2013) shows that *in utero* investments are indeed indicative of parents' preference for sons.

5.3 Measurement

The main variables in the structural parameter estimation are measured as follows.

First, in (11), the endogenous variable $logE$ is a non-linear function of the wage of both parents, and the price and quality of daycare. Given that the Census—the dataset for obtaining parenting time for the structural estimation—does not contain data on the hourly daycare cost, daycare quality, or hourly *potential* wages, I obtain predictions for them from the NLSCY and the LFS, for households observed in the Census, separately for Québec and the rest-of-Canada, for 1996 and 2001. Second, to construct the outcomes in (9) and (11), I obtain a prediction for child expenditures—including children's toys, games, and books, and clothing—from the SHS. The following variables are used for prediction: parents' education and age, province, children's age, and household composition and size. I obtain a prediction for parental depression score capturing mental health $\bar{P}$, only for the pre-period, assumed to be fixed even if daycare price changes, which is consistent with the model assumption that parents treat PPT as fixed. ***Data Appendix B*** lists the underlying statements from which depression score is constructed (*e.g.*, "*I felt that I could not shake off the blues even with help from my family/friends.*"; "*I had trouble keeping my mind on what I was doing.*"; "*I felt that everything I did was an effort.*").

A make a few remarks on the prediction. First, there is admittedly loss of information (variation) due to the predictions; but, reassuringly, ***Appendix J/II*** shows the details of the predictions, model R^2's, and that the predicted averages in the prediction sample are close to the actual averages in the estimation sample (Tables J2–J3). Importantly, the R^2's for wages and daycare measures, forming the main endogenous variable $logE$, are high. Hence, in $logE$ the information loss is relatively small.[44]

Second, and importantly, optimal time-use of parents on the left-hand-side of (9) and (11) is not predicted, but directly observed, and so is they key regressor S (parents' years of schooling).

Third, given that the structural parameter estimation involves predicted (estimated) variables, I use bootstrap for estimating the variance-covariance matrix when estimating (9) and (11) using the method of Ordinary and Two-staged Least Squares, respectively. Also, because the estimated regression coefficients in (11) are non-linear functions of the structural parameters as discussed above, I apply the Delta Method for deriving the exact form of the standard errors for the structural parameters.[45]

Fourth, to assess robustness, I even use two measures for both daycare price and daycare quality. The first hourly daycare cost measure (P1) is from the NLSCY, the first daycare quality measure (Q1) is the share of aspects in which the daycare meets the parents' expectations, and the second daycare quality measure (Q2) is the average group size in daycare (both from the NLSCY, from waves 7-8 and 3-4, respectively). The second daycare price measure (P2) utilizes the Canadian Tax and Credit Simulator (CTaCS) developed by Milligan (2016), to construct the simulated daycare subsidy and the hourly effective price of daycare.[46] Finally, predicting potential wages means that the structural estimation sample includes currently non-working parents, and is not subject to sample selection concerns.

[44] The structural parameter estimates are robust to the set of prediction variables (results are available upon request).
[45] For details of the derivation, *see* ***Appendix I.***
[46] *See* ***Appendix J/III*** for details of the simulation and arriving at the hourly effective price of daycare.

5.4 Results of the Structural Parameter Estimation

Table 5 shows the estimation results of the IV model (11) and the OLS model (9) for parenting time, using the Census data for 1996 and 2001. I present the results using different measures of daycare quality (Q1, Q2) and daycare price (P1, P2), to show that the magnitude of structural estimates are robust to measurement. The value of the joint *F-statistics* in the 1^{st}-stage equation for $logE$ (12) in columns (1)–(2) are 78.7 and 20.2, and both $\pi_1 = 0$ and $\pi_1 + \pi_2 = 0$ are rejected, supporting **ID2'**.[47]

In *Panel B* in Table 5, the regression coefficient estimates imply a substitution parameter between parenting time and market goods in child skill formation, as perceived by parents, of -2.96 (-2.56) for high-educated (low-educated) parents. These estimates are not significantly different from one another, and are significant at the 10 percent level.[48] They imply strong (perceived) complementarity between time and market goods in child skill formation, which is not only consistent with existing evidence, but improves on them, as time-varying unobserved heterogeneity likely biases the estimates of Moschini (2023) (-0.68) and Abbott (2022) (-0.56) towards zero, and the IV estimates of Caucutt et al. (2023) (-0.8) do not differ from their OLS estimates, suggesting that predicted wages and time and state indicators as IVs do not correct for the endogeneity stemming from unobserved parenting skills.

The estimates $\hat{\delta} = 0.787$ and $\hat{\xi} = -0.509$ (column (1), significant at the 10 percent level) imply that parents perceive their time investments in child skill formation to increase with years of schooling and to decrease with depression, conditional on parenting ability. The first result is consistent with that of Cunha et al. (2022), which finds that disadvantaged parents underestimate the return to their investment in their children. The estimated preference and birth weight parameters are significantly positive ($\hat{\varphi} = 0.595$ and $\hat{\varsigma} = 1.109$ (column (3)), indicating that preference for child human capital increases with years of schooling, and initial child human capital increases with child birth weight.

6 Decomposition of Heterogeneous Responses and Counterfactuals

This section presents several decompositions and counterfactuals, using the structural parameter estimates and assuming that child human capital K is produced from parenting time (T_K) and daycare time as the sole child market good (X_K): (i) I estimate the relative importance of the various channels behind parents' heterogeneous responses in T_K to cheaper daycare; (ii) I assess how a policy like the one in Québec's in 1997 shapes the predicted early childhood skill gap between high- and low-educated parents' children; (iii) I decompose the predicted increase in K into a *direct* channel through more X_K, and an *indirect* channel through more T_K; and (iv) I replicate previous findings of the policy's, *on average*, negative effects on child outcomes (Baker et al., 2008) (details are in ***Appendix J/I***).

As an initial step, I verify that with the structural estimates and *fixed PPT*, the model successfully

[47] $\hat{\pi}_1 = 0.52$ (s.e. 0.05) and $\hat{\pi}_1 = 0.47$ (s.e. 0.08), respectively, while $\hat{\pi}_2$ is positive and insignificant in both cases.

[48] For the robustness check in column (2), the implied (less precise) point estimates for ρ_K are around -3.5. For home production (results not shown in Table 5, but available upon request), the regression coefficients imply a substitution parameter between time and market goods of 0.482 and 0.514 for high- and low-educated, respectively. These estimates suggest substitutability between time and market goods in home production, and are also consistent with existing evidence by Aguiar and Hurst (2007), and support the mechanism put forward by Doepke et al. (2019) for why parental education can have a direct effect on the level of parental investments, namely that they have more means to substitute their time away from home production towards more high-value interactions with children.

replicates the reduced-form finding (2) on parents' heterogeneous responses in T_K to cheaper daycare for high- and low-educated parents, using the structural estimates and average *actual* inputs using data on parents in Québec from 1996, with the following procedure. First, I plug in the structural estimates (from Table 5) and average inputs in Québec from 1996 (on wages, incomes, daycare price, daycare quality, schooling, mental health, and birth weight) from Tables J2–J3 into the optimal demand for child goods, to predict $\hat{X}_K^*$ (predicted daycare hours of parents in Québec before the daycare price falls); here, I determine the level of innate parenting ability and effort (ε_γ) so that the predicted gap in daycare hours in Québec pre-1997 matches the actual gap (40.15 percent in the data). Second, I determine the level of heterogeneity in preference for child human capital (ε_β) so that the level of predicted daycare hours matches the actual levels of daycare use (in hours) in pre-1997 Québec. Third, I consider the post-1997 level of daycare price-to-quality ratio ($\frac{m}{Q}$) such that for both high- and low-educated parents the predicted increase in daycare use (in hours) matches the actual increase (as seen in Table D2). Fourth, I predict the parenting time increase ($\uparrow \hat{T}_K^*$) that stems solely due to the change in $\frac{m}{Q}$ from the previous step. I verify that $\uparrow \hat{T}_K^*$ is 2.65 and 2.07 percent for high- and low-educated mothers, and it is 3.15 and 2.57 percent for high- and low-educated fathers, respectively. Reassuringly, these predicted increases match actual increases: 2.82 and 1.33 percent for high- and low-educated mothers, and 3.78 and 1.9 percent for high- and low-educated fathers, respectively, as seen in Table 3.

Next, I quantify the relative importance of the various channels in explaining the difference between high- and low-educated parents' time allocation, arising due to: (1a) preference for child human capital, (1b) wage, (2) PPT in child skill formation, (3) substitutability between time and market goods, and (4) birth weight. Table 6 shows the portion of the difference explained by (1)–(4), shutting them down one-by-one. Given that in eq. (9) the constant β_0 (in preferences) cannot be separately identified from the constant $\bar{C}$ (in the shadow price), I present the sum of channels (1a)+(1b).

Panel A in 6 shows that the relative importance of the channels [PPT : wage & preference : birth weight] in explaining why high-educated parents spend more time with their children in the cross-section is roughly [(-1) : 10 : 4], before daycare becomes cheaper. Thus, while PPT explains the cross-sectional gap in parenting time in the negative direction (as predicted by the model), its magnitude is small.

Panel B in 6 shows the relative importance of the channels [PPT : wage & preference : substitution : birth weight] in explaining high-educated parents' stronger parenting time response to cheaper daycare: [4 : (-2) : (-1) : 4]. Thus, the difference implied by PPT is roughly equivalent to the difference implied by initial child human capital (birth weight), buttressing that PPT, the productivity of parenting time, plays a key role in high-educated parents' stronger parenting time response to cheaper daycare.

Finally, I look at the predicted levels of child human capital ($\hat{K}$) in Québec before and after daycare becomes cheaper, to assess early childhood skill gaps. Initially, I *keep the productivity of parenting time (PPT) constant*, which is consistent with the model assumption that parents treat their PPT as fixed. In ***Appendix J/IB*** I find that due to cheaper daycare, high- and low-educated parents' $\hat{K}$ increases by 16 and 12 percent, respectively (due to increased daycare and parenting times), resulting in a 16 percent wider skill gap. If the policy targeted only low-educated parents, the gap is predicted to decrease by 10.5 percentage points (relative to prior to the policy).[49] For both high-

[49]Results are robust to using the alternative daycare price and quality (P2 and Q2) measures: (1) high-educated parents' $\hat{K}$ increases by 18.5 percent, whereas low-educated parents' $\hat{K}$ increases by 14 percent; (2) the skill gap widens

and low-educated parents, around $\frac{1}{3}$ of the predicted increase in child human capital due to cheaper daycare is *via* increased daycare use (the *direct* channel), while $\frac{2}{3}$ is *via* increased parenting time (the *indirect* channel).[50] Thus, a daycare price drop as in Québec in 1997, with complementarity between parental time and market goods of around -2.7, would lead expected child human capital to increase two-fold, relative to what could be expected solely from the mechanical *direct* channel *via* increased daycare use, implying that complementarity magnifies the role of such a daycare price policy.

In the last step, I *allow the productivity of parenting time (PPT) to decrease*, and find that my model, together with the structural estimates, is able to replicate previous findings of the, on average, worsening child outcomes in this policy context in (*e.g.*, Baker et al., 2008; Kottelenberg and Lehrer, 2017). Assuming that parents' depression score increases by 10 percent, as found in Baker et al. (2008), and keeping the procedure exactly as above, my model predicts child human capital to deteriorate by 2.8 and 4 percent for high- and low-educated parents' children, respectively—which can be explained by worse parental mental health and lower *actual* PPT as a result. The deterioration in child human capital my model, together with the structural estimates, predicts is consistent with the actual findings of Baker et al. (2008) that eligible children's anxiety, aggression, and motor-social-development (MSD) scores deteriorated by 12.4, 8.7, and 1.7 percent, respectively, in the 1997 Québec policy context.

7 Reduced-Form Responses to Cheaper Daycare, by Mothers' Predicted Propensity to Work in Absence of the Cheap Daycare Policy

Finally, I aim to shed light on why eligibility for cheaper daycare led, on average, to worse parenting practices, parental mental health, and child outcomes (Baker et al., 2008), thereby adding to the heterogeneity analysis by Kottelenberg and Lehrer (2017). I compare mothers who would work and use daycare even in the absence of cheap daycare, with mothers who would be induced to (re)join the labor market by the 1997 Québec daycare policy – the motivation for this heterogeneity dimension is that (re)joining work may elevate time pressure and stress for parents, possibly affecting their mental health (and Section 6 suggests a strong relationship between parental mental health and child outcomes).[51]

Given the repeated cross-section data structure, I estimate policy impacts separately for households in which the mother's (predicted) propensity to work in absence of the policy is low *vs.* high:

$$\begin{aligned} Y_i \quad = \gamma_0 + \gamma_1 \text{policy}_{tp} + \gamma_2 \text{policy}_{tp} \cdot 1\{\hat{prop}_i \leq p25\} + \gamma_3 1\{\hat{prop}_i \leq p25\} + \gamma_4 C_i + \gamma_5 U_i + \\ \gamma'_{6t} + \gamma'_{7p} + \gamma'_8 X_i + \gamma_9 \text{post}_t \cdot 1\{\hat{prop}_i \leq p25\} + \gamma_{10} \text{Que}_p \cdot 1\{\hat{prop}_i \leq p25\} + \eta_i, \end{aligned} \tag{13}$$

by 18.5 percent, but if the policy targeted low-educated parents, the gap would decrease by 12.5 percentage points; (3) the direct effect of cheap daycare is around 23 percent for both types of parents; (4) the relative importance of time productivity in the cross-sectional gap is negligible, and of the [PPT : wage&preference : substitution : birth weight] channels in high-educated parents' larger parenting time increase after the policy is [3 : (-2) : (-1) : 4].

[50] The magnitude of the direct channel is 30.2 (33.7) percent for high-(low-)educated parents (*see* ***Appendix J/IB***).

[51] To further motivate this question, note that given Section 3.4, mothers simultaneously increase their labor supply, work time, and child time at the expense of home production and leisure. One may wonder if this time trade-off is made by mothers who would not be working in the absence of the policy, but would increase their labor supply due to the policy. Mothers who would work full-time in absence of the policy presumably would not adjust their labor supply, but would only make use of the positive income shock for market goods, affecting their intra-household time allocation. If these latter types are driving the results, then mothers' larger child time increase could be solely due to composition.

where $\hat{prop}_i$ denotes the mother's propensity to work in absence of cheap daycare, and $1\{\hat{prop}_i \leq p25\}$ flags households in which the mother's propensity to work is in the lowest quartile. γ_1 shows the policy impact for households in which the mother's propensity is above the lowest quartile (*i.e.,* being more likely to work even in absence of cheap daycare), and γ_2 captures the differential policy impact for households in which the mother's propensity is in the lowest quartile (*i.e.*, being unlikely to work if cheap daycare is not available). To obtain $\hat{prop}_i$, I estimate a probit model on the pre-policy sample using pre-determined variables that are not altered by the policy change (both parents' educational attainment, a full set of province and child age fixed effects, the parents' age, household size, and a linear time trend), and I predict $\hat{prop}_i$ for the whole sample. To account for the estimation error in this estimation process, I bootstrap standard errors when estimating the model (13) (400 iterations).[52]

I estimate model (13) separately for high- and low-educated parents, for various outcomes: the mother's labor supply on both margins (from the LFS), parents' propensity to read to their children weekly (from the NLSCY), the mother's (standardized) depression score (from the NLSCY), a binary indicators of daycare use (in any care and in institutional care, such as in daycare centres, from the NLSCY), parenting time in hours per week of both parents (from the Census), and standardized parenting quality scores, capturing aversive and hostile/ineffective parenting, and standardized child development scores, capturing physical aggression and separation anxiety (from the NLSCY). These indices are constructed for the NLSCY from qualitative responses to individual questions; specifically, the Person Most Knowledgeable (PMK, typically the mother) in the NLSCY had to evaluate how often statements belonging to a given measure are true. Note that the NLSCY administrators determined with Principal Component Analysis which statements belong to which factor/score, which I take as given and only age-standardize the aggregated scores. For instance, a statement/question belonging to aversive parenting is "*When [child's name] breaks the rules, how often do you raise your voice, scold or yell at him/her?*", one belonging to hostile/ineffective parenting is "*How often do you think the kind of punishment you give your child depends on your mood?*", one belonging to child physical aggression is "*[How often would you say that [child's name] kicks, bites, hits other children?*", and one belonging to separation anxiety is "*How often would you say that [child's name] clings to adults or is too dependent?*". (The detailed construction of these measures is in ***Appendix B***.)

Table 7 shows the estimation result of (13): High- and low-educated mothers who are more likely to work even if cheap daycare were not available increase their propensity to work by 4.2 and 2.4 percentage points, and increase their working hours by 1.4 and 0.7 hours per week, respectively, due to the policy; in parallel, they also significantly increase their daycare use by any care (by 12.7 and 6.4 percentage points) and in institutional care (by 18.9 and 14.7 percentage points). These mothers likely become more stressed, as evinced by an increase in their depression score (by 14 and 18 percent of a standard deviation), and their parenting practices becoming more hostile and aversive. Consistently, their children's aggression and separation anxiety scores increase significantly due to cheaper daycare. The parenting, mental health and child outcomes of—especially high-educated—mothers who would be drawn (back) into the labor market by cheaper daycare actually do not worsen.

There are no significant differences for either high- or low-educated parents in their parenting time

[52] The estimation details are in ***Appendix K*** in Table K1, and the distribution of the estimated propensity score is illustrated in Figure K1. Conclusions are robust to a model in which I interact policy_{tp} with $\hat{prop}_i$ and $\hat{prop}_i^2$.

responses to cheaper daycare, by (predicted) propensity. The absence of such relationship suggests that parents whose PPT might *actually* change differently due to cheaper daycare, more work, and potentially affected mental health have nevertheless similar time responses, consistent with the model's assumption that parents consider their PPT as fixed and unrelated to their time allocations.

8 Concluding Remarks

In this paper, I study parents' perceptions of two key features of child skill formation: of whether parenting time and child market goods (*e.g.*, daycare, books) are complements, and if high-educated parents' time is more productive in it. I present new reduced-form responses to cheaper universal daycare, using policy variation from 1997 in Québec: (1) parents allocate more time to their children and buy more child market goods, and (2) high-educated parents increase their parenting time more.

I interpret findings (1)–(2) *via* a comprehensive model of parental time allocation, wherein productivity of parenting time (PPT) depends on parents' education levels, innate parenting ability, and mental health. I estimate the model's key structural parameters, which reveal that (i) parents perceive parenting time and child market goods as strong complements, and (ii) high-educated perceive their parenting time as more productive. The mechanism is as follows: as daycare becomes cheaper and parents' opportunity cost of time in non-work activities increases, parents become wealthier and market goods become cheaper relative to time investments, and they demand more market goods—both child-skill-enhancing and home-production-related—due to their positive income and substitution effects. Then, parents substitute their time away from activities where they believe time and market goods are substitutes (as in home production) to activities where they believe time and market goods are complements (as in child skill formation). My model explains (1)–(2) through an interaction between (i)–(ii): as daycare price falls, parents with greater PPT will increase their parenting time more.

Using the structural estimates, I find that if parents' productivity of parenting time is unaltered when daycare price falls, the level of child human capital is predicted to increase more for high-educated parents' children, exacerbating inequality and widening early childhood skill gaps. Also, an overwhelming part of the predicted increase stems *indirectly* from more parenting time (and not *directly* from more daycare time). Thus, complementarity magnifies the role of a daycare price policy.

I close with two areas of potential future research. First, while this paper focused on parents' perceptions, understanding the discrepancy between perceptions and the truth is key for policy; *e.g.*, if low-educated parents systematically underestimate the true productivity of their parenting time, then interventions can target the correction of such misperception.[53] But, if parents are aware of the real returns to their parenting time, and instead lack focus and attention to be present with their children, then interventions can target mindful parenting, mental health, and parents' emotional stability.

Second, a strand of literature investigates whether parents invest in a reinforcing or a compensatory manner with respect to their children's initial endowment (Rosenzweig and Wolpin, 1988; Datar, 2006; Giannola, 2024; Aizer and Cunha, 2012; Hsin, 2012). A similarly important question is how par-

[53] In this stream, Kalil et al. (2019) presents the result of an intervention that provided behavioral tools (reminders, goal-setting, and social rewards) to parents to increase time spent with their children, and York et al. (2019) presents the result of an intervention that aimed to provide information about the important skills children should learn in preschool.

ents' mental health and their parenting time investments change with respect to their (changing) labor supply. I find two pieces evidence suggesting that parents perhaps do not perfectly realize (or foresee) their parenting time productivity (PPT) to change when daycare price falls and the mother increases her labor supply: (i) families in which the mother would *vs.* would not work in absence of cheap daycare increase their parenting time to a similar extent, when daycare becomes cheaper, even though the elevated stress and time pressure from increased labor supply – potentially affecting parents' mental health – may be more prevalent in the former types of families; (ii) my model replicates the reduced-form findings if parents acted as *if their PPT was fixed* and their mental health did not worsen. These results may warrant further research on parents' potentially changing mental health when working more, their parenting time allocation and its effectiveness, and ultimately, early childhood skill gaps.

References

Abbott, B. (2022). Incomplete Markets and Parental Investments in Children. *Review of Economic Dynamics*, 44:104–124.

Agostinelli, F. and Sorrenti, G. (2021). Money vs. Time: Family Income, Maternal Labor Supply, and Child Development. Working Paper 2018-017, HCEO WP Series, The University of Chicago.

Aguiar, M. and Hurst, E. (2007). Life-Cycle Prices and Production. *American Economic Review*, 97(5):1533–1559.

Aizer, A. and Cunha, F. (2012). The Production of Human Capital: Endowments, Investments and Fertility. Working Paper No. 18429, National Bureau of Economic Research.

Almlund, M., Duckworth, A. L., Heckman, J., and Kautz, T. (2011). In Hanushek, E. A., Machin, S., and Woessmann, L., editors, *Handbook of The Economics of Education*, volume 4 of *Handbook of the Economics of Education*, pages 1–181. Elsevier.

Attanasio, O., Cattan, S., Fitzsimons, E., Meghir, C., and Rubio-Codina, M. (2020). Estimating the Production Function for Human Capital: Results from a Randomized Controlled Trial in Colombia. *American Economic Review*, 110(1):48–85.

Baker, M. (2011). Innis Lecture: Universal Early Childhood Interventions: What is the Evidence Base? *Canadian Journal of Economics*, 44(4):1069–1105.

Baker, M., Gruber, J., and Milligan, K. (2005). Universal Child Care, Maternal Labor Supply, and Family Well-Being. Working Paper 11832, National Bureau of Economic Research.

Baker, M., Gruber, J., and Milligan, K. (2008). Universal Child Care, Maternal Labor Supply, and Family Well-Being. *Journal of Political Economy*, 116(4):709–745.

Baker, M., Gruber, J., and Milligan, K. (2019). The Long-Run Impacts of a Universal Child Care Program. *American Economic Journal: Economic Policy*, 11(3):1–26.

Baker, M. and Milligan, K. (2016). Boy-Girl Differences in Parental Time Investments: Evidence from Three Countries. *Journal of Human Capital*, 10(4):1–44.

Bauernschuster, S. and Schlotter, M. (2015). Public Child Care and Mothers' Labor Supply: Evidence from Two Quasi-Experiments. *Journal of Public Economics*, 123:1–16.

Becker, G. S. (1965). A Theory of the Allocation of Time. *The Economic Journal*, 75(299):493–517.

Berlinski, S. and Galiani, S. (2007). The Effect of a Large Expansion of Pre-Primary School Facilities on Preschool Attendance and Maternal Employment. *Labour Economics*, 14(3):665–680.

Berlinski, S., Galiani, S., and Gertler, P. (2009a). The Effect of Pre-Primary Education on Primary School Performance. *Journal of Public Economics*, 92(1-2):219–234.

Berlinski, S., Galiani, S., and Manacorda, M. (2009b). Giving Children a Better Start: Preschool Attendance and School-Age Profiles. *Journal of Public Economics*, 92(5-6):1416–1440.

Bharadwaj, P. and Lakdawala, L. K. (2013). Discrimination Begins in the Womb: Evidence of Sex-Selective Prenatal Investments. *Journal of Human Resources*, 48(1):71–113.

Black, S. E., Devereux, P. J., Loken, K. V., and Salvanes, K. G. (2014). Care or Cash? The Effect of Child Care Subsidies on Student Performance. *Review of Economics and Statistics*, 96(5):824–837.

Blau, D. and Tekin, E. (2007). The Determinants and Consequences of Child Care Subsidies for Single Mothers in the USA. *Journal of Population Economics*, 20(4):719–741.

Borghans, L., Duckworth, A. L., Heckman, J. J., and ter Weel, B. (2008). The Economics and Psychology of Personality Traits. *Journal of Human Resources*, 43(4):972–1059.

Brilli, Y. (2022). Mother's Time Allocation, Childcare, and Child Cognitive Development. *Journal of Human Capital*, 16(2):233–272.

Brodeur, A. and Connolly, M. (2013). Do Higher Child Care Subsidies Improve Parental Well-being? Evidence from Quebec's Family Policies. *Journal of Economic Behavior and Organization*, 93:1–16.

Cameron, A. C., Gelbach, J. B., and Miller, D. L. (2008). Bootstrap-Based Improvements for Inference with Clustered Errors. *The Review of Economics and Statistics*, 90(3):414–427.

Campbell, S., Cohn, J., Murray, L., and Cooper, P. (1997). Postpartum Depression and Child Development.

Carneiro, P. and Ginja, R. (2014). Long-Term Impacts of Compensatory Preschool on Health and Behavior: Evidence from Head Start. *American Economic Journal: Economic Policy*, 6(4):135–73.

Carneiro, P. and Ginja, R. (2016). Partial Insurance and Investments in Children. *The Economic Journal*, 126(596):F66–F95.

Carneiro, P., Heckman, J. J., and Masterov, D. V. (2005). Labor Market Discrimination and Racial Differences in Premarket Factors. *Journal of Law and Economics*, 48(1):1–39.

Carneiro, P., Loken, K. V., and Salvanes, K. G. (2015). A Flying Start? Maternity Leave Benefits and Long-Run Outcomes of Children. *Journal of Political Economy*, 123(2):365–412.

Carr, A. and Pike, A. (2012). Maternal Scaffolding Behavior: Links With Parenting Style and Maternal Education. *Developmental Psychology*, 48(2):543–551.

Carter, A. S., Garrity-Rokous, F. E., Chazan-Cohen, R., Little, C., and Briggs-Gowan, M. J. (2001). Maternal Depression and Comorbidity: Predicting Early Parenting, Attachment Security, and Toddler Social-Emotional Problems and Competencies. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(1):18–26.

Cascio, E. (2015). The Promises and Pitfalls of Universal Early Education. *IZA World of Labor*.

Cascio, E. and Schanzenbach, D. W. (2013). The Impacts of Expanding Access to High-Quality Preschool Education. *Brookings Papers on Economic Activity*, 47(2):127–192.

Case, A., Lubotsky, D., and Paxson, C. (2002). Economic Status and Health in Childhood: The Origins of the Gradient. *American Economic Review*, 92(5):1308–1334.

Caucutt, E. M., Lochner, L., Mullins, J., and Park, Y. (2023). Child Skill Production: Accounting for Parental and Market-Based Time and Goods Investments. *WP, University of Western Ontario*.

Chaparro, J., Sojourner, A., and Wiswall, M. J. (2020). Early Childhood Care and Cognitive Development. Working Paper 26813, National Bureau of Economic Research.

Chetty, R., Friedman, J. N., Hilger, N., Saez, E., Schanzenbach, D. W., and Yagan, D. (2011). How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project Star. *The Quarterly Journal of Economics*, 126(4):1593–1660.

Cobb-Clark, D. A., Salamanca, N., and Zhu, A. (2019). Parenting Style as an Investment in Human Development. *Journal of Population Economics*, 32(4):1315–1352.

Cornelissen, T., Dustmann, C., Raute, A., and Schonberg, U. (2017). Who Benefits from Universal Child Care? Estimating Marginal Returns to Early Child Care Attendance. *Journal of Political Economy*, 126:2356–2409.

Cunha, F., Elo, I., and Culhane, J. (2022). Maternal Subjective Expectations About the Technology of Skill Formation Predict Investments in Children A Year Later. *Journal of Econometrics*, 231(1):3–32.

Cunha, F. and Heckman, J. J. (2008). Formulating, Identifying and Estimating the Technology of Cognitive and Noncognitive Skill Formation. *Journal of Human Resources*, 43(4):738–782.

Cunha, F., Heckman, J. J., and Lochner, L. (2006). *Interpreting the Evidence on Life Cycle Skill Formation*, volume 1 of *Handbook of the Economics of Education*, chapter 12, pages 697–812. Elsevier.

Cunha, F., Heckman, J. J., and Schennach, S. M. (2010). Estimating the Technology of Cognitive and Noncognitive Skill Formation. *Econometrica*, 78(3):883–931.

Currie, J. and Almond, D. (2011). *Human Capital Development Before Age Five*, volume 4 of *Handbook of Labor Economics*, chapter 5, pages 1315–1486. Elsevier.

Currie, J. and Stabile, M. (2003). Socioeconomic Status And Child Health: Why Is The Relationship Stronger For Older Children? *American Economic Review*, 93(5):1813–1823.

Datar, A. (2006). Does Delaying Kindergarten Entrance Give Children a Head Start? *Economics of Education Review*, 25(1):43–62.

Datta Gupta, N. and Simonsen, M. (2010). Non-Cognitive Child Outcomes and Universal High Quality Child Care. *Journal of Public Economics*, 94(1):30–43.

de Chaisemartin, C. and D'Haultfoeuille, X. (2020). Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects. *American Economic Review*, 110(9):2964–96.

de Chaisemartin, C. and D'Haultfoeuille, X. (2022). Two-Way Fixed Effects and Differences-in-Differences with Heterogeneous Treatment Effects: A Survey. *The Econometrics Journal*, 26(3):1–30.

Del Boca, D., Flinn, C., and Wiswall, M. (2014). Household Choices and Child Development. *The Review of Economic Studies*, 81(1 (286)):137–185.

Del Bono, E., Ermisch, J., and Francesconi, M. (2012). Intrafamily Resource Allocations: A Dynamic Structural Model of Birth Weight. *Journal of Labor Economics*, 30(3):657–706.

Del Bono, E., Francesconi, M., Kelly, Y., and Sacker, A. (2016). Early Maternal Time Investment and Early Child Outcomes. *The Economic Journal*, 126(596):96–135.

Deming, D. J. (2018). The Growing Importance of Social Skills in the Labor Market. *The Quarterly Journal of Economics*, 132(4):1593–1640.

Doepke, M., Sorrenti, G., and Zilibotti, F. (2019). The Economics of Parenting. *Annual Review of Economics*, 11(1):55–84.

Doepke, M. and Zilibotti, F. (2017). Parenting With Style: Altruism and Paternalism in Intergenerational Preference Transmission. *Econometrica*, 85(5):1331–1371.

Drange, N. and Ronning, M. (2020). Child Care Center Quality and Early Child Development. *Journal of Public Economics*, 188.

Duncan, G., Kalil, A., Mogstad, M., and Rege, M. (2022). Investing in Early Childhood Development in Preschool and at Home. Working Paper 29985, National Bureau of Economic Research.

Falk, A., Kosse, F., Pinger, P., Schildberg-Hörisch, H., and Deckers, T. (2021). Socioeconomic Status and Inequalities in Children's IQ and Economic Preferences. *Journal of Political Economy*, 129(9):2504–2545.

Fiorini, M. and Keane, M. P. (2014). How the Allocation of Children's Time Affects Cognitive and Noncognitive Development. *Journal of Labor Economics*, 32(4):787–836.

Fitzpatrick, M. D. (2010). Preschoolers Enrolled and Mothers at Work? The Effects of Universal Prekindergarten. *Journal of Labor Economics*, 28(1):51–85.

Fryer, R. G. and Levitt, S. D. (2004). Understanding the Black-White Test Score Gap in the First Two Years of School. *The Review of Economics and Statistics*, 86(2):447–464.

Fryer, R. G. and Levitt, S. D. (2006). The Black-White Test Score Gap Through Third Grade. *American Law and Economics Review*, 8(2):249–281.

Fryer, R. G. and Levitt, S. D. (2013). Testing for Racial Differences in the Mental Ability of Young Children. *American Economic Review*, 103(2):981–1005.

Gelbach, J. B. (2002). Public Schooling for Young Children and Maternal Labor Supply. *American Economic Review*, 92(1):307–322.

Gelber, A. M. and Mitchell, J. W. (2012). Taxes and Time Allocation: Evidence from Single Women and Men. *The Review of Economic Studies*, 79(3):863–897.

Gensowski, M., Landers, R., Dale, P., Hojen, A., Justice, L., and Bleses, D. (2024). Public and Parental Investments, and Children's Skill Formation. Working Paper 16956, IZA.

Giannola, M. (2024). Parental Investments and Intra-household Inequality in Child Human Capital: Evidence from a Survey Experiment. *The Economic Journal*, 134(658):671–727.

Goodman-Bacon, A. (2021). Difference-in-Differences with Variation in Treatment Timing. *Journal of Econometrics*, 225(2):254–277.

Gordon, J. A., Herbst, C. M., and Tekin, E. (2010). Who's Minding the Kids? Experimental Evidence on the Demand for Child Care Quality. *Economics of Education Review*, 29:618–638.

Gould, E. D., Simhon, A., and Weinberg, B. A. (2020). Does Parental Quality Matter? Evidence on the Transmission of Human Capital Using Variation in Parental Influence from Death, Divorce, and Family Size. *Journal of Labor Economics*, 38(2):569–610.

Gronau, R. (1977). Leisure, Home Production, and Work–the Theory of the Allocation of Time Revisited. *Journal of Political Economy*, 85(6):1099–1123.

Guryan, J., Hurst, E., and Kearney, M. (2008). Parental Education and Parental Time with Children. *Journal of Economic Perspectives*, 22(3):23–46.

Haeck, C., Lebihan, L., and Merrigan, P. (2018). Universal Child Care and Long-Term Effects on Child Well-Being: Evidence from Canada. *Journal of Human Capital*, 12(1):38–98.

Haeck, C., Lefebvre, P., and Merrigan, P. (2015). Canadian Evidence on Ten Years of Universal Preschool Policies: The Good and the Bad. *Labour Economics*, 36:137–157.

Haeck, C., Lefebvre, P., Merrigan, P., and Lebihan, L. (2022). Childcare, Parental Behavior and Well-Being during Childhood. *The B.E. Journal of Economic Analysis & Policy*, 22(2):311–360.

Hale, L., Berger, L. M., LeBourgeois, M. K., and Brooks-Gunn, J. (2011). A Longitudinal Study of Preschoolers' Language-based Bedtime Routines, Sleep duration, and Well-being. *Journal of Family Psychology*, 25(3):423–433.

Hart, B. and Risley, T. R. (1995). *Meaningful Differences in the Everyday Experience of Young American Children.* Paul H. Brookes Publishing, Baltimore, MD.

Havnes, T. and Mogstad, M. (2011a). Money for Nothing? Universal Child Care and Maternal Employment. *Journal of Public Economics*, 95(11):1455–1465.

Havnes, T. and Mogstad, M. (2011b). No Child Left Behind: Subsidized Child Care and Children's Long-Run Outcomes. *American Economic Journal: Economic Policy*, 3(2):97–129.

Havnes, T. and Mogstad, M. (2015). Is Universal Child Care Leveling the Playing Field? *Journal of Public Economics*, 127:100–114.

Heckman, J. J. and Cunha, F. (2007). The Technology of Skill Formation. *American Economic Review*, 97(2):31–47.

Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., and Yavitz, A. (2010). The Rate of Return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94(1-2):114–128.

Heckman, J. J. and Mosso, S. (2014). The Economics of Human Development and Social Mobility. *Annual Review of Economics*, 6(1):689–733.

Heckman, J. J., Pinto, R., and Savelyev, P. (2013). Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes. *American Economic Review*, 103(6):2052–86.

Heckman, J. J., Stixrud, J., and Urzua, S. (2006). The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. *Journal of Labor Economics*, 24(3):411–482.

Herbst, C. M. and Tekin, E. (2010). Child Care Subsidies and Child Development. *Economics of Education Review*, 29:618–638.

Hill, C. R. and Stafford, F. P. (1974). Allocation of Time to Preschool Children and Educational Opportunity. *The Journal of Human Resources*, 9(3):323–341.

Hoff, E. (2003). The Specificity of Environmental Influence: Socioeconomic Status Affects Early Vocabulary Development via Maternal Speech. *Child Development*, 74(5):1368–1378.

Hsin, A. (2012). Is Biology Destiny? Birth Weight and Differential Parental Treatment. *Demography*, 49(4):1385–1405.

Japel, C., Tremblay, R. E., and Cote, S. (2005). Quality Counts! Assessing the Quality of Daycare Services based on the Quebec Longitudinal Study of Child Development. *IRPP Choices*, 11(5).

Kaitz, M., Maytal, H. R., Devor, N., Bergman, L., and Mankuta, D. (2010). Maternal Anxiety, Mother–Infant Interactions, and Infants' Response to Challenge. *Infant Behavior and Development*, 33(2):136–148.

Kalb, G. and van Ours, J. C. (2014). Reading to Young Children: A Head-Start in Life? *Economics of Education Review*, 40:1–24.

Kalil, A., Mayer, S., Oreopoulos, P., and Gallego, S. (2019). Using Behavioral Insights To Increase Parental Engagement: The Parents and Children Together (PACT) Intervention. *Journal of Human Resources*, 54(4):900–925.

Kalil, A., Ryan, R., and Corey, M. (2012). Diverging Destinies: Maternal Education and the Developmental Gradient in Time With Children. *Demography*, 49(4):1361–1383.

Kim, J. H., Schulz, W., Zimmermann, T., and Hahlweg, K. (2018). Parent-Child Interactions and Child Outcomes: Evidence from Randomized Intervention. *Labour Economics*, 54:152–171.

Kosse, F., Deckers, T., Pinger, P., Schildberg-Hörisch, H., and Falk, A. (2020). The Formation of Prosociality: Causal Evidence on the Role of Social Environment. *Journal of Political Economy*, 128(2):434–467.

Kottelenberg, M. J. and Lehrer, S. F. (2013). New Evidence on the Impacts of Access to and Attending Universal Child-Care in Canada. *Canadian Public Policy*, 39(2):263–286.

Kottelenberg, M. J. and Lehrer, S. F. (2017). Targeted or Universal Coverage? Assessing Heterogeneity in the Effects of Universal Child Care. *Journal of Labor Economics*, 35(3):609–653.

Lee, S. Y. T. and Seshadri, A. (2019). On the Intergenerational Transmission of Economic Status. *Journal of Political Economy*, 127(2):855–921.

Lefebvre, P. and Merrigan, P. (2008). Child-Care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada. *Journal of Labor Economics*, 26(3):519–548.

Lefebvre, P., Merrigan, P., and Verstraete, M. (2009). Dynamic Labour Supply Effects of Childcare Subsidies: Evidence from a Canadian Natural Experiment on Low-fee Universal Child Care. *Labour Economics*, 16(5):490–502.

Leibowitz, A. (1974). Home Investments in Children. *Journal of Political Economy*, 82(2):111–131.

Lochner, L. and Bastian, J. (2022). The Earned Income Tax Credit and Maternal Time Use: More Time Working and Less Time with Kids? *Journal of Labor Economics*, 40(3):573–611.

Loken, K. V., Lommerud, K. E., and Holm Reiso, K. (2018). Single Mothers and Their Children: Evaluating a Work-Encouraging Welfare Reform. *Journal of Public Economics*, 167:1–20.

Lovejoy, M. C., Graczyk, P. A., O'Hare, E., and Neuman, G. (2000). Maternal Depression and Parenting Behavior: A Meta-Analytic Review. *Clinical Psychology Review*, 20(5):561–592.

Lundin, D., Mork, E., and Ockert, B. (2008). How Far Can Reduced Childcare Prices Push Female Labour Supply? *Labour Economics*, 15:647–659.

Magnuson, K. A., Ruhm, C. J., and Waldfogel, J. (2007). Does Prekindergarten Improve School Preparation and Performance? *Economics of Education Review*, 26:33–51.

Milligan, K. (2016). Canadian Tax and Credit Simulator. Database, Software and Documentation, Version 2016-1. Working Paper, Vancouver School of Economics, University of British Columbia.

Montpetit, S., Carrer, L., and Beauregard, P.-L. (2023). A Welfare Analysis of Universal Childcare: Lessons From a Canadian Reform. Working Paper, Toulouse School of Economics, mimeo.

Moschini, E. (2023). Child Care Subsidies and Child Skill Accumulation in One- and Two-Parent Families. *American Economic Journal: Macroeconomics*, 15(1):475–516.

Murray, L., Cooper, P., Creswell, C., Schofield, E., and Sack, C. (2007). The Effects of Maternal Social Phobia on Mother–Infant Interactions and Infant Social Responsiveness. *Journal of Child Psychology and Psychiatry*, 48(1):45–52.

Murray, L., Lau, P. Y., Arteche, A., Creswell, C., Russ, S., Zoppa, L. D., Muggeo, M., Stein, A., and Cooper, P. (2012). Parenting by Anxious Mothers: Effects of Disorder Subtype, Context and Child Characteristics. *Journal of Child Psychology and Psychiatry*, 53(2):188–196.

Osborne, M. (2005). How Important is Your Personality? Labor Market Returns to Personality for Women in the US and UK. *Journal of Economic Psychology*, 26(6):827–841.

Osborne, M., Gintis, H., and Bowles, S. (2001). The Determinants of Earnings: A Behavioral Approach. *Journal of Economic Literature*, 39(4):1137–1176.

Price, J. and Kalil, A. (2019). The Effect of Mother-Child Reading Time on Children's Reading Skills: Evidence from Natural Within-Family Variation. *Child Development*, 9(6):688–702.

Rosenzweig, M. R. and Wolpin, K. I. (1988). Heterogeneity, Intrafamily Distribution, and Child Health. *Journal of Human Resources*, 23(4):437–461.

Rowe, M. L. (2008). Child-Directed Speech: Relation to Socioeconomic Status, Knowledge of Child Development and Child Vocabulary Skill. *Journal of Child Language*, 35:198–205.

Rubinstein, Y. and Heckman, J. J. (2001). The Importance of Noncognitive Skills: Lessons from the GED Testing Program. *American Economic Review*, 91(2):145–149.

Seror, A. (2022). Child Development in Parent-Child Interactions. *Journal of Political Economy*, 130(9):2462–2499.

Todd, P. E. and Wolpin, K. I. (2003). On the Specification and Estimation of the Production Function for Cognitive Achievement. *The Economic Journal*, 113(485):3–33.

Weinberg, B. (2001). An Incentive Model of the Effect of Parental Income on Children. *Journal of Political Economy*, 109(2):266–280.

Weinberg, M. K., Beeghly, M., Olson, K. L., and Tronick, E. (2008). Effects of Maternal Depression and Panic Disorder on Mother–Infant Interactive Behavior in the Face-to-Face Still-Face Paradigm. *Infant Mental Health Journal: Official Publication of The World Association for Infant Mental Health*, 29(5):472–491.

Weisleder, A. and Fernald, A. (2013). Talking to Children Matters: Early Language Experience Strengthens Processing and Builds Vocabulary. *Psychological Science*, 24(11):2143–2152.

York, B. N., Loeb, S., and Doss, C. (2019). One Step at a Time: The Effects of an Early Literacy Text Messaging Program for Parents of Preschoolers. *Journal of Human Resources*, 54(3):537–566.

Tables

General Notes for Tables 1-4:

— *Panel A* shows the estimates of coefficients and standard errors on the policy and education variables from estimating the Difference-in-Differences models (1) and (2), *i.e.,* the Intent-to-Treat effect (ITT) estimates. Outcome variables are indicated in bold on the top of the tables.

— "High-educated" refers to families in which the mother has at least some post-secondary studies, and "low-educated" refers to families in which the mother has at most a high school degree, in the family.

— The policy variable is an interaction between residing in Québec and being eligible to the policy by cohort. In odd (even) columns, its coefficient estimates show the policy impact for all (low-educated) families.

— In even columns, the coefficient estimates on the interaction variable (policy·high-educ.) show whether the policy impact differs for high- *vs.* low-educated families; these estimates correspond to model (2).

— Each regression controls for: province and year fixed effects, mother's education, gender and age of the child, age of the parents, number and age of siblings, number of other household members.

— In *Panel B,* for each outcome, the first column shows the weighted mean in the estimation sample in the control group ($policy = 0$), while the second column shows the estimated ITT impact $\hat{\beta}_1 + \hat{\beta}_2$, to be able to assess the size of the impact relative to the baseline mean.

— The *p-values* in *Panel C* correspond to the two-sided test with null-hypothesis $H_0 : \beta_1 + \beta_2 = 0$ (and with alternative hypothesis $H_1 : \beta_1 + \beta_2 \neq 0$); *i.e.*, to test whether the ITT impact is zero for high-educated families.

— Standard error estimates are in parentheses and standard errors are clustered at the province-post level. The significance levels are indicated with: *** p<0.01, ** p<0.05, * p<0.1.

Table 1: **Effect of a Daycare Price Decrease on Daycare Use (Extensive Margin) and Maternal Labor Supply (Both Margins); Difference-in-Differences Policy Impact for All and by Education**

	1: in institutional care		**1: in any care**		**1: mother working**		**mother hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.184***	0.127***	0.127***	0.086***	0.076***	0.042**	1.081***	0.414*
	(0.008)	(0.011)	(0.011)	(0.066)	(0.007)	(0.016)	(0.172)	(0.221)
β_2 : policy		0.075***		0.058***		0.039*		0.756**
·high-educ		(0.023)		(0.020)		(0.019)		(0.361)
β_3 : college	0.048***	0.032***	0.153***	0.164***	0.173***	0.174***	5.160***	4.857***
	(0.014)	(0.011)	(0.011)	(0.017)	(0.011)	(0.015)	(0.396)	(0.357)
β_4 : university	0.076***	0.061***	0.195***	0.206***	0.191***	0.192***	6.506***	6.208***
	(0.011)	(0.008)	(0.008)	(0.012)	(0.017)	(0.016)	(0.606)	(0.471)
R^2	0.124	0.125	0.118	0.118	0.095	0.096	0.074	0.074
N	61,962	61,962	61,962	61,962	61,496	61,496	186,941	186,941
data	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	LFS	LFS
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	0.092	0.184	0.437	0.131	0.614	0.076	19.296	1.081
low-educ.	0.053	0.131	0.312	0.088	0.481	0.042	15.097	0.414
high-educ.	0.106	0.201	0.484	0.141	0.663	0.09	21.376	1.170
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.000		0.000

Note: Outcome variables are indicated in bold; the first three indicate (i) whether the child is in institutional care (whether using care in a daycare centre (including at workplace) or care in a before or after school program, in columnns (1)-(2)), (ii) whether the child is any care (in institutional care, care in others' home or care in own home, in columns (3)-(4)), (iii) whether the mother is working/employed (in columns (5)-(6)), and the fourth is hours worked by the mother (including 0 if not working, in columns (7)-(8)). **Data:** National Longitudinal Survey of Children and Youth (NLSCY), waves 1-7 (1994–2006) in columns (1)–6), Labor Force Surveys (LFS), 1994–2006 in (7)–(8), 0–4 years old children in two-parent families in which both parents are 20–50 years old.

Table 2: **Effect of a Daycare Price Decrease on Reading to the Child; Difference-in-Differences Policy Impact for All and by Education**

	1: never reading		**1: reading weekly**		**1: reading often**		**1: reading daily**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	-0.032***	-0.029**	0.0194***	0.003	0.036***	0.042***	-0.026***	-0.022
	(0.0037)	(0.0117)	(0.0017)	(0.0063)	(0.0032)	(0.0124)	(0.0035)	(0.0261)
β_2 : policy		-0.003		0.022***		-0.011		-0.004
·high-educ		(0.0142)		(0.0076)		(0.0200)		(0.0366)
β_3 : college	-0.047***	-0.042***	-0.019***	-0.019***	-0.032**	-0.046**	0.099***	0.108***
	(0.005)	(0.010)	(0.004)	(0.005)	(0.012)	(0.018)	(0.015)	(0.030)
β_4 : university	-0.070***	-0.066***	-0.031***	-0.032***	-0.072***	-0.086***	0.174***	0.184***
	(0.013)	(0.014)	(0.003)	(0.006)	(0.016)	(0.022)	(0.021)	(0.037)
R^2	0.118	0.119	0.015	0.015	0.035	0.035	0.139	0.139
N	60,858	60,858	60,858	60,858	60,858	60,858	60,858	60,858
data	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	0.088	-0.032	0.037	0.019	0.202	0.036	0.672	-0.026
low-educ.	0.129	-0.029	0.055	0.003	0.248	0.042	0.567	-0.022
high-educ.	0.073	-0.032	0.030	0.025	0.184	0.031	0.712	-0.026
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.002		0.0344

Note: Outcome variables are in bold and they are all binary, indicating reading time of parents to their children. **Data:** NLSCY, waves 1-7 (1994–2006), 0–4 years old children in two-parent families in which both parents are 20–50 years old.

Table 3: **Effect of a Daycare Price Decrease on Mother's and Father's Parenting Time and Home Production Time Use; Difference-in-Differences Policy Impact for All and by Education**

	mother parenting time		**mother home production time**		**father parenting time**		**father home production time**	
Panel A: Regression Results for the Level of Time								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.870***	0.591**	-2.046***	-2.233***	0.718***	0.442*	-1.084***	-1.215***
	(0.1052)	(0.2385)	(0.130)	(0.271)	(0.135)	(0.220)	(0.059)	(0.188)
β_2 : policy		0.677**		0.528		0.484*		0.278
·high-educ		(0.2766)		(0.334)		(0.241)		(0.260)
β_3 : college	1.175***	1.809***	-1.232***	-0.793***	1.505***	1.714***	0.097	0.106
	(0.374)	(0.143)	(0.345)	(0.262)	(0.223)	(0.136)	(0.201)	(0.115)
β_4 : university	-0.313	0.315*	-4.272***	-3.848***	1.741***	1.947***	-0.451**	-0.456***
	(0.293)	(0.164)	(0.575)	(0.347)	(0.108)	(0.248)	(0.199)	(0.119)
R^2	0.067	0.067	0.023	0.023	0.028	0.028	0.016	0.016
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
data	CENSUS	CENSUS	CENSUS	CENSUS	CENSUS	CENSUS	CENSUS	CENSUS
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	44.824	0.870	30.523	-2.046	24.104	0.718	14.115	-1.084
low-educ.	44.409	0.591	32.403	-2.233	23.203	0.442	14.169	-1.215
high-educ.	45.020	1.268	29.637	-1.805	24.530	0.927	14.089	-0.935
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.000		0.000
Panel D: Regression Results for the Log of Parenting Time								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.051***	0.052***			0.058***	0.052***		
	(0.003)	(0.007)			(0.006)	(0.009)		
β_2 : policy		0.005				0.009		
·high-educ		(0.008)				(0.009)		
R^2	0.057	0.058			0.019	0.019		
N	676,810	676,810			653,600	653,600		

Notes: In the Canadian Census, respondents were asked how many hours last week they spent on "(a) doing unpaid housework, yard work or home maintenance for members of this household, or others?" and "...(b) looking after own children, without pay?", with the following options: i) none, ii) <5 hours, iii) 5-14 hours, iv) 15-29 hours, v) 30-59 hours, vi) 60< hours. The outcomes, indicated in bold in this table, are continuous variables, measured by the midpoint of the bins i)-vi). **Data:** Canadian Census (1996, 2001, 2006), two-parent families in which the youngest child is 0–4 years old and both parents are 20–50 years old.

Table 4: **Effect of a Daycare Price Decrease on Food Expenditures, Child Good Expenditures and Home Production Good Expenditures (%); Difference-in-Differences Policy Impact for All and by Education**

	food expenditures (%)			**food - from store (%)**			**food - from restaurant(%)**		
Panel A: Regression Results									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_1 : policy	0.817***	0.939***	2.108***	0.436***	0.558***	1.403***	0.322***	0.343***	0.623***
	(0.114)	(0.144)	(0.234)	(0.117)	(0.127)	(0.182)	(0.057)	(0.098)	(0.148)
β_2 : policy			-1.097***			-0.637**			-0.407***
·high-educ			(0.282)			(0.256)			(0.097)
β_3 : college	-0.922**	-1.001***	-0.804***	-1.020***	-1.098***	-0.950***	0.103	0.100	0.145*
	(0.319)	(0.301)	(0.207)	(0.279)	(0.260)	(0.171)	(0.069)	(0.066)	(0.074)
β_4 : university	-1.562***	-1.689***	-1.508***	-1.666***	-1.782***	-1.658***	0.101*	0.088	0.142*
	(0.291)	(0.262)	(0.198)	(0.323)	(0.297)	(0.148)	(0.050)	(0.054)	(0.069)
R^2	0.13	0.17	0.17	0.13	0.17	0.18	0.04	0.04	0.04
N	22,725	7,228	7,228	22,725	7,228	7,228	22,725	7,228	7,228
Panel B: Means and Policy Impacts									
	mean	*mean*	*impact*	*mean*	*mean*	*impact*	*mean*	*mean*	*impact*
all	12.978	13.095	0.939	10.751	10.603	0.558	2.412	2.457	0.343
low-educ.	N/A	14.845	2.108	N/A	12.269	1.403	N/A	2.539	0.623
high-educ.	N/A	12.047	1.011	N/A	9.608	0.766	N/A	2.406	0.216
Panel C: P-values of Testing Coefficients									
$\beta_1 + \beta_2 = 0$			0.000			0.001			0.021
	daycare (%)			**games-toys (%)**			**domestic help (%)**		
Panel A: Regression Results									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
β_1 : policy	-0.125**	-0.374***	0.428***	0.089***	0.155***	0.086	0.023**	0.094***	0.049**
	(0.047)	(0.073)	(0.136)	(0.018)	(0.017)	(0.068)	(0.008)	(0.006)	(0.018)
β_2 : policy			-1.093***			0.134			0.032
·high-educ			(0.179)			(0.090)			(0.026)
β_3 : college	0.116	0.163*	0.109	0.028	0.015	0.143*	0.002	0.006	-0.002
	(0.088)	(0.087)	(0.134)	(0.048)	(0.049)	(0.068)	(0.019)	(0.018)	(0.024)
β_4 : university	0.512***	0.603***	0.542**	0.038	0.017	0.159**	0.161***	0.172***	0.165***
	(0.121)	(0.127)	(0.181)	(0.057)	(0.054)	(0.062)	(0.029)	(0.031)	(0.019)
R^2	0.04	0.05	0.05	0.05	0.04	0.05	0.03	0.06	0.06
N	22,725	7,228	7,228	22,725	7,228	7,228	20,578	5,081	5,081
Panel B: Means and Policy Impacts									
	mean	*mean*	*impact*	*mean*	*mean*	*impact*	*mean*	*mean*	*impact*
all	2.075	2.088	-0,374	0.796	0.851	0.155	0.121	0.119	0.094
low-educ.	N/A	1.627	0.428	N/A	0.866	0.086	N/A	0.0402	0.049
high-educ.	N/A	2.365	-0.665	N/A	0.842	0.220	N/A	0.158	0.081
Panel C: P-values of Testing Coefficients									
$\beta_1 + \beta_2 = 0$			0.000			0.001			0.000

Note: For each outcome variable (indicated in bold in the column titles), the first column shows the result of estimating model (1) for the entire time period, while the second column shows the result of estimating model (1) for years when parental education data is available in the SHS data; the third column shows the result of estimating model (2), also only for years when parental education data is available in the SHS data. The household expenditures include food expenditures (all/from store/from restaurant), expenditures on hiring domestic help, and expenditures on the child (daycare expenditures and expenditures on child books, toys and games). All aforementioned expenditures are measured in percentages, out of all expenditures. **Data:** Canadian Survey of Household Spending (1986,1992,1996-2009), two-parent households with at least one 0-4 years old child, and both parents being 20–50 years old.

Table 5: **Estimation of Structural Parameters from the Model's Marshallian Demands**

outcome	$logY^A$	$logY^A$	$logY^B$	$logY^B$
estimation eq.	(8)	(8)	(65)	(65)
daycare m measure:	P1	P2	P1	P2
daycare Q measure:	Q1	Q2	Q1	Q2
Panel A: Estimated Coefficients and Bootstrapped Standard Errors				
	(1)	(2)	(3)	(4)
$logE$	-0.2809***	-0.2414***		
	(0.08881)	(0.0834)		
$logE$·high-educ	0.02845**	0.03149**		
	(0.01329)	(0.01393)		
$logS$	-0.58166***	-0.6732***	0.5951***	0.5403***
	(0.2029)	(0.2364)	(0.00596)	(0.00513)
$logP$	0.3764**	0.4063***		
	(0.1623)	(0.1315)		
$logW$			1.1089***	1.7247***
			(0.0403)	(0.03625)
constant	-4.0416***	-3.7103***	-1.0920***	-2.9377***
	(1.2963)	(1.0610)	(0.0480)	(0.04371)
N	409,850	422,820	442,340	425,410
Panel B: Structural Parameters and Standard Errors via Delta Method				
Substitution Parameters and Time Producivity Parameters				
implied ρ_K^L	-2.5598*	-3.1418		
	(1.3843)	(2.0211)		
implied ρ_K^H	-2.9609*	-3.7630		
	(1.7064)	(2.7253)		
implied δ	0.7874*	0.8625		
	(0.4702)	(0.7114)		
implied ξ	-0.5095*	-0.5205		
	(0.3140)	(0.4281)		
implied γ_0	237.741*	116.016*		
	(140.081)	(69.981)		
Preference and birth weight Parameters				
implied φ			0.5951***	0.5403***
			(0.00596)	(0.00513)
implied ς			1.1089***	1.7247***
			(0.0403)	(0.03625)
implied β_0			0.3355***	0.05299***
			(0.0480)	(0.04371)

Note: For details on empirical strategy, the implied structural parameters and their standard errors *via* the Delta Method in *Panel B*, *see* Sections 5.3, ***Appendix H*** and ***I***. **Data:** Census (1996,2001), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. Construction of endogenous E_K is described in ***Appendix J/II***. Instrument: $policy_{tp}$.

Table 6: **Decomposition of Five Channels in Predicted Parenting Time Before a Daycare Price Decease and in Predicted Parenting Time Increase After a Daycare Price Decrease**

daycare m measure:	predicted m (P1)				percent subsidy (P2)			
daycare Q measure:	parental expectations (Q1)				class size (Q2)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Predicted Parenting Time (in Levels) Before Daycare Price Decrease								
maternal education:	**high**	**low**	$\triangle_1$	**share**	**high**	**low**	$\triangle_1$	**share**
baseline	13.6206	10.0155	3.6051		3.1449	2.1893	0.9556	
1. equating w, m and preference β_K	13.6206	12.4314	1.1892	67.01%	3.1449	2.6950	0.4498	52.925%
2. equating substitution ρ_K	13.6206	12.544	1.0760	3.138%	3.1449	2.7126	0.4322	1.8450%
3. equating time productivity PPT γ_K	13.6206	12.291	1.3290	-7.0173%	3.1449	2.6807	0.4641	-3.3424%
4. equating birth weight K_0	13.6206	13.6207	0	36.866%	3.1449	3.1449	0	48.572%
Panel B: Predicted Parenting Time Increase After Daycare Price Decrease								
maternal education:	**high**	**low**	$\triangle_2$	**share**	**high**	**low**	$\triangle_2$	**share**
baseline	0.3951	0.3393	0.0557		0.0514	0.0444	0.0070	
1. equating w, m and preference β_K	0.3951	0.3222	0.0728	-30.568%	0.0514	0.0396	0.0117	-67.395%
2. equating substitution ρ_K	0.3951	0.3140	0.0810	-14.761%	0.0514	0.0374	0.0399	-31.866%
3. equating time productivity PPT γ_K	0.3951	0.356	0.0385	76.171%	0.0514	0.0438	0.0075	91.185%
4. equating birth weight K_0	0.3951	0.3951	0	69.158%	0.0514	0.0514	0	108.077%

Note: For the details on the structural decomposition, *see* ***Appendix J***.

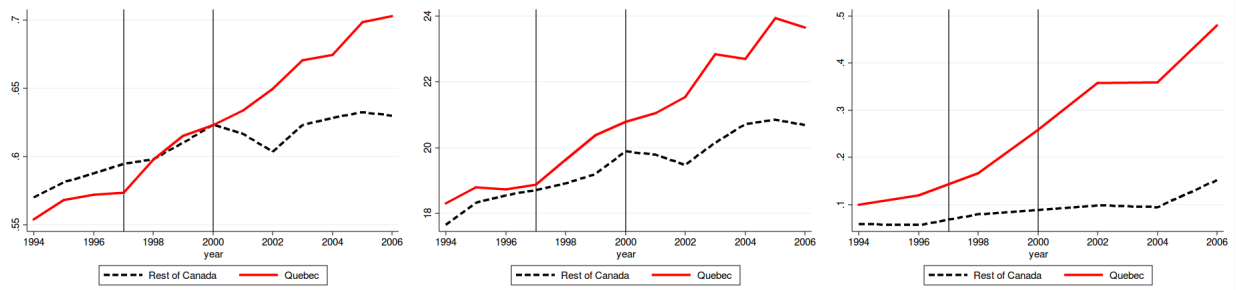
Table 7: **Effect of Cheaper Daycare on Parenting Time, Depression, Parenting and Child Outcomes; Policy Impact by the Propensity of the Mother to Work in the Absence of the Policy and by Education**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Mother's Labor Supply (on Both Margins), Parental Reading, and Mother's Depression Score								
	1: mother working		**mother's hours**		**1: reading weekly**		**mother's depression**	
parental education:	*high*	*low*	*high*	*low*	*high*	*low*	*high*	*low*
γ_1 : policy	0.0417***	0.0241***	1.4230***	0.7222***	0.0197***	.0031	0.1394***	0.1758***
	(0.0043)	(0.0069)	(0.1667)	(0.2591)	(0.0019)	(0.0034)	(0.0121)	(0.0176)
γ_2 : policy	-0.0108	-0.0068	-1.1246***	-0.5483	-0.0075	0.0038	-0.1630***	0.0471
$\cdot 1\{\hat{prop}_i \leq p25\}$	(0.0101)	(0.0107)	(0.3406)	(0.5632)	(0.0097)	(0.0117)	(0.0300)	(0.0864)
γ_3 : $1\{\hat{prop}_i \leq p25\}$	-0.0283***	-0.0284***	-1.3650***	-1.1563**	0.0006	0.0136	-0.0295	0.1051***
	(0.0091)	(0.0081)	(0.2491)	(0.4962)	(0.0033)	(0.0121)	(0.0212)	(0.0384)
N	148,150	77,250	148,020	77,150	43,840	17,020	44,560	17,410
p-value of $\gamma_1 + \gamma_2 = 0$	0.0180	0.1250	0.4223	0.695	0.0231	0.5076	0.3575	0.0103
data	LFS	LFS	LFS	LFS	NLSCY	NLSCY	NLSCY	NLSCY
Panel B: Daycare Use and Mother's Parenting Time and Father's Parenting Time (Both in Hours per Week)								
	1: in any daycare		**1: in institutional daycare**		**mother's parenting time**		**father's parenting time**	
parental education:	*high*	*low*	*high*	*low*	*high*	*low*	*high*	*low*
γ_1 : policy	0.1273***	0.0639***	0.1885***	0.1468***	1.2380***	0.6973***	0.6696**	-2.2767
	(0.0120)	(0.0110)	(0.0104)	(0.0082)	(0.0989)	(0.2521)	(0.2950)	(1.8432)
γ_2 : policy	-0.0328	-0.0042	-0.0758***	-0.0612***	0.3370	-0.4219	1.3654*	0.1627
$\cdot 1\{\hat{prop}_i \leq p25\}$	(0.0202)	(0.0206)	(0.0099)	(0.0076)	(0.3381)	(0.5831)	(0.7153)	(2.0376)
γ_3 : $1\{\hat{prop}_i \leq p25\}$	-0.0218	-0.0059	0.0435	0.0291**	1.0616***	0.8100***	2.6960***	0.4187
	(0.0139)	(0.0186)	(0.0097)	(0.0108)	(0.3223)	(0.3173)	(0.8503)	(1.1660)
N	44,560	17,410	44,560	17,410	468,060	230,430	1,230	600
p-value of $\gamma_1 + \gamma_2 = 0$	0.000	0.009	0.000	0.000	0.000	0.5685	0.0041	0.0166
data	NLSCY	NLSCY	NLSCY	NLSCY	CENSUS	CENSUS	CENSUS	CENSUS
Panel C: (Standardized) Parenting Quality Scores and (Standardized) Child Development Scores								
	parental aversity		**parental hostility**		**physical aggression**		**separation anxiety**	
parental education:	*high*	*low*	*high*	*low*	*high*	*low*	*high*	*low*
γ_1 : policy	0.1151***	0.1296***	0.1681***	0.2968***	0.1043***	0.1437***	0.0678***	0.05166***
	(0.0157)	(0.0257)	(0.0119)	(0.0420)	(0.0095)	(0.0212)	(0.0091)	(0.0096)
γ_2 : policy	-0.0816***	-0.0280	-0.1192***	-0.0977**	-0.0874***	0.0664**	-0.0906***	0.0082
$\cdot 1\{\hat{prop}_i \leq p25\}$	(0.0379)	(0.0447)	(0.0422)	(0.0403)	(0.0234)	(0.0349)	(0.0294)	(0.0156)
γ_3 : $1\{\hat{prop}_i \leq p25\}$	0.0418*	0.0642**	0.0000	0.0438	-0.0672***	-0.0277	-0.0214	0.0089
	(0.0286)	(0.0364)	(0.0263)	(0.0527)	(0.0097)	(0.0390)	(0.0279)	(0.0179)
N	26,090	10,510	44,560	17,410	44,560	17,410	44,560	17,410
p-value of $\gamma_1 + \gamma_2 = 0$	0.3478	0.0198	0.2831	0.0057	0.4009	0.0001	0.3364	0.0001
data	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY	NLSCY

Note: results of estimating model (13); $1\{\hat{prop}_i \leq p25\}$ indicates if the predicted propensity of the mother working in the absence of the policy is below the 25^{th} percentile. Bootstrapped standard errors with 400 iterations. **Data:** Census (1996,2001,2006), LFS (1994-2006), NLSCY (waves 1–7), two-parent families with a 0-4 years old child, both parents at most 50 years old.

Figures

Figure 1: **Trends in Québec and the Rest-of-Canada in Maternal Employment (Both Margins: Employment and Work Hours) and Institutional Daycare Use, 1994–2006**



Note: The first two graphs show the weighted mean of women's employment rate and hours worked (below the age of 50, living in two-parent households), for Québec and the Rest-of-Canada between 1994 and 2006. Data: LFS (1994-2006), mothers with 0-4 years old children in two-parent families, both parents at most 50 years old. In 1997 the Québec "5$/day" subsidized universal daycare policy was phased-in gradually for children aged 0-4 until 2000. The third graph shows the weighted mean of regulated (institutional) daycare use, for Québec and the Rest-of-Canada between 1994 and 2006. **Data:** NLSCY waves 1-7 (1994-2006), 0-4 years old children in two-parent families, both parents at most 50 years old.

Appendix

A Appendix: Further Details on the 1997 Québec Daycare Policy

Figures A1 below illustrate that the fraction of those working in NAICS code "6244 - Child Day Care Services" with at most a high-school degree (a post-secondary or university degree) decreased (increased) in Québec relative to the Rest-of-Canada, in 1994–2006, and also the average hourly earnings of those working in NAICS code "6244 - Child Day Care Services" increased in Québec relative to the Rest-of-Canada, in 1994–2006.

Figure A1: **Share of Daycare Teachers With At Most High School Degree and Post-Secondary and University Degree, and Their Average (Deflated) Hourly Earnings, in Québec and the Rest-of-Canada, 1994-2006**

Note: these figures show the fraction of workers (with LFS status = 1, *i.e.*, employed and at work), with various levels of education, and their average hourly earnings (deflated to 2002 level) with NAICS code "6244 - Child Day Care Services". Data: LFS, 1994-2006.

B Appendix: Data Description and Measurement

1. Brief Description of Data Sources

— The NLSCY follows the development and well-being of Canadian children from birth to early adulthood, and it collects information about factors influencing a child's social, behavioral, and emotional development. An initial sample of children under the age of 12 was sampled in 1994 and followed for 14 years through 2008. Starting at Cycle 2, a new cohort of children younger than two-year-old was added in each cycle, following the expansion of the NLSCY, emphasizing early childhood development. Data in the first (second) cycle is representative of children under 12 (14) in 1994 (1996), *etc.*

— The LFS provides detailed labor market data on the civilian population above 14 years of age.[54] Besides labor market data, basic demographic information, such as gender and exact date of birth, is available for all family members in the household. The LFS uses a rotating panel sample design, where selected households remain in the sample for six consecutive months.

— The two main objectives of the GSS are to collect data on social trends to monitor changes in the living circumstances of Canadians, and to collect responses on a rotating set of particular topics, such as commuting to work, labor market outcomes and perceptions, society and community, time-use and unpaid work, *etc.* One of the rotating topics is time use, measured in 1998, 2005, and 2010. The target population consists of all non-institutionalized persons 15 or older, living in the Canadian provinces.

— The SHS collects information on household expenditures, annual income from personal income tax data, demographic characteristics, and certain dwelling characteristics. It combines a questionnaire with recall periods based on the type of expenditure and a daily expenditure diary, with a target sample similar to that of the LFS'.[55]

2. Measurement of Variables Used From the NLSCY

— **Daycare Use:** In each wave of the NLSCY, the Person Most Knowedgeable (PMK) is asked whether (s)he is "using child care such as daycare or babysitting while you (and your spouse/partner) are at work or studying." In addition, (s)he is also asked about the mode of child care, such as: (1) care provided in someone else's home by a non-relative, (2) care in someone else's home by a relative, (3) care in own home by brother or sister of the child, (4) care in own home by a relative other than a sister or brother of the child, (5) care in own home by a non-relative, (6) care in a daycare centre (including at workplace), (7) care in a before or after school program. Finally, she is asked for how many hours child care is used, and in the case of (1), (2), (3) and (5), whether the person providing this care licensed by the government or approved by a family daycare agency, and in the case of (6), whether the child care program or daycare centre operated on a profit or non-profit basis (including government sponsored care). Based on these, I form the following outcome variables:

variable name	variable description	variable type
1: in institutional care	whether using (6) care in a daycare centre (including at workplace) or (7) care in a before or after school program	indicator
1: care in others' home	whether using (1) care provided in someone else's home by a non-relative, or (2) care in someone else's home by a relative	indicator
1: care in own home	whether using (3) care in own home by sibling of the child, or (4) care in own home by a relative other than a sibling of the child, or (5) care in own home by a non-relative	indicator
1: in any care	whether using institutional care, care in others' home or care in own home	indicator

[54] Excluding persons living on Aboriginal reserves, full-time members of the Canadian Forces, and the institutionalized.
[55] More information about the LFS, GSS and SHS datasets is available here, here and here, respectively.

— **Mother's Labor Supply:** In each wave, the PMK is asked whether (s)he is working for pay or profit, and if not, what is the reason (own illness/disability, pregnancy, caring for own children/elder relatives, other personal or family responsibilities, school or educational leave, labor dispute, temporary layoff due to seasonal or non-seasonal conditions, permanent layoff, unpaid or partially paid leave, other). Based on this, I form the outcome variable **1{mother is working}** if the PMK is the mother and she is working for pay or profit.

— **Parental Reading:** In each wave, the PMK is asked about that "[c]urrently, how often do you or another adult read to [the child]? (Also include if he/she reads or pretends to read to adult.)", with the answer possibilities being (1) never or rarely, (2) less than once a month, (3) once a month, (4) a few times a month, (5) once a week, (6) a few times a week, (7) daily, (8) many times each day. I form the following outcome variables:

variable name	variable description	variable type
1: never reading	whether (1) never or rarely reading to the child, or reading (2) less than once a month, or reading (3) once a month to the child, or reading (4) a few times a month to the child	indicator
1: reading weekly	whether reading (5) once a week to the child	indicator
1: reading often	whether reading (6) a few times a week to the child	indicator
1: reading daily	whether reading (7) daily, or (8) many times each day to the child	indicator

— **Parenting Practices:** for each scale (parenting and behavioral), the following procedures were used:

1. the sample of respondents for each scale (and age group, if the scale used different questions for different groups), was randomly divided into two half-samples;
2. principal component analysis was carried out separately on each half-sample to find out how many factors should be extracted in the factor analysis performed subsequently;
3. the scores for various factors were aggregated, and the aggregated scores were age-standardized (so that for each age, the mean is 0 and standard deviation is 1 for a given score).

For **hostile/ineffective parenting**, the following seven items were found to load into this factor:

hostile-ineffective parenting items
1. How often do you get annoyed with your child for saying or doing something he/she is not supposed to?
2. Of all the times you talk to your child about his/her behaviour, what proportion is praise?
3. Of all the times you talk to your child about his/her behaviour, what proportion is disapproval?
4. How often do you get angry when you punish your child?
5. How often do you think the kind of punishment you give your child depends on your mood?
6. How often do you feel you have problems managing your child in general?
7. How often do you have to discipline your child repeatedly for the same thing?

PMK's had the following answer options: 1: never, 2: about once a week or less/less than half the time, 3: a few times a week/about half the time, 4: one or two times a day/more than half the time, 5: many times each day/all the time. Answers were rescaled to 0 to 4 (i.e., the category "never" was scored as 0, the category "about once a week or less/less than half the time" was scored as 1, etc.), the scores were summed, and a score of 0 represents the absence of a problem and a score of 28 is the highest possible score with respect to problems. All scores below were calculated similarly, unless explicitly described.

For **positive/consistent/aversive parenting**, the following items were found to load into these factors:

positive parenting items
1. How often do you praise [the child], by saying something like "Good for you!"/"What a nice thing you did!"/"That's good going!"?
2. How often do you and he/she talk or play with each other, focusing attention on each other for five minutes or more, just for fun?
3. How often do you and he/she laugh together?
4. How often do you do something special with him/her that he/she enjoys?
5. How often do you play sports, hobbies or games with him/her?
consistent parenting items
1. When you give him/her a command or order to do something, what proportion of the time do you make sure that he/she does it?
2. If you tell him/her he/she will get punished if not stopping to do something, and he/she keeps doing it, how often will you punish?
3. How often is he/she able to get out of a punishment when he/she really sets his/her mind to it?
4. How often when you discipline him/her, does he/she ignore the punishment?
aversive parenting items: [When [child's name] breaks the rules, how often do you:]
1. Calmly discuss the problem?
2. Use physical punishment?
3. Describe alternative ways of behaving that are acceptable?
4. Raise your voice, scold or yell at him/her?

— **Behavioral Scores:**

For **hyperactivity-inattention score**, the following five/seven items were found to load into this factor:

hyperactivity-inattention items: [How often would you say that [child's name]:]	**ages 2-3**	**ages 4-11**
1. Cannot sit still, is restless or hyperactive?	·	·
2. Fidgets?	·	·
3. Cannot concentrate, cannot pay attention for long?	·	·
4. Cannot settle to anything for more than a few moments?	·	·
5. Is inattentive?	·	·
6. Is impulsive, acts without thinking?		·
7. Has difficulty awaiting turn in games or groups?		·

For **emotional disorder-anxiety score**, the following six/eight items were found to load into this factor:

emotional disorder-anxiety items: [How often would you say that [child's name]:]	**ages 2-3**	**ages 4-11**
1. Seems to be unhappy, sad or depressed?	·	·
2. Is not as happy as other children?	·	·
3. Is too fearful or anxious?	·	·
4. Is worried?	·	·
5. Is nervous, highstrung or tense?	·	·
6. Has trouble enjoying him/herself?	·	·
7. Cries a lot?		·
8. Appears miserable, unhappy, tearful, or distressed?		·

For **separation anxiety score**, the following four items were found to load into this factor:

separation anxiety items: [How often would you say that [child's name]:]	**ages 2-3**
1. When another child accidentally hurts him/her (such as by bumping into him/her), assumes that the other child meant to do it, and then reacts with anger and fighting?	·
2. Clings to adults or is too dependent?	·
3. Kicks, bites, hits other children?	·
4. Does not want to sleep alone?	·

For **physical aggression score**, the following nine items were found to load into this factor:

physical aggression items: [How often would you say that [child's name]:]	**ages 4-11**
1. Destroys his/her own things?	·
2. Gets into many fights?	·
3. Destroys things belonging to his/her family, or other children?	·
4. Doesn't want to sleep alone?	·
5. When another child accidentally hurts him/her (such as by bumping into him/her), assumes that the other child meant to do it, and then reacts with anger and fighting?	·
6. Physically attacks people?	·
7. Threatens people?	·
8. Is cruel, bullies or is mean to others?	·
9. Kicks, bites, hits other children?	·

— **Depression Score:** the following ten items were found to load into this factor:

depression score items: [How often you have felt or behaved this way during the past week:]
1. I did not feel like eating; my appetite was poor.
2. I felt that I could not shake off the blues even with help from my family or friends.
3. I had trouble keeping my mind on what I was doing.
4. I felt depressed.
5. I felt that everything I did was an effort.
6. I felt hopeful about the future.*
7. My sleep was restless.
8. I was happy.*
9. I enjoyed life.*
10. I felt that people disliked me.

Answer options "1: rarely or none of the time (less than 1 day), 2: some or a little of the time (1-2 days), 3: occasionally or a moderate amount of time (3-4 days), 4: most or all of the time (5-7 days)" were rescaled to 0 to 3 (*i.e.*, the category rarely" was scored as 0, the category "some or a little of the time (1-2 days)" was scored as 1, *etc.*, with those indicated with * reversed), the scores were summed, and a score of 0 represents the absence of depression and a score of 30 indicates the highest depressive symptoms. I age-standardize the scores.

— **Family Functioning Score:** the following 13 items were found to load into this factor:

family functioning items: [How often you have felt or behaved this way during the past week:]
1. Planning family activities is difficult because we misunderstand each other.
2. In times of crisis we can turn to each other for support.*
3. We cannot talk to each other about sadness we feel.
4. Individuals (in the family) are accepted for what they are.*
5. We avoid discussing our fears or concerns.
6. We express feelings to each other.*
7. There are lots of bad feelings in our family.
8. We feel accepted for what we are.*
9. Making decisions is a problem for our family.
10. We are able to make decisions about how to solve problems.*
11. We do not get along well together.
12. We confide in each other.*
13. Drinking is a source of tension or disagreement in our family.

C Appendix: The Non-Cognitive/Behavioral Skill Gap Regressions

My findings on differential parental time responses link to the literature on human capital gaps in early childhood. There is evidence on significant cognitive, noncognitive (also called behavioral or developmental),[56] and health gaps between high- and low-educated parents' children, opening up early and widening as children become older.[57] Although the literature on these gaps often uses the label 'early childhood,' the majority of this evidence relies on at least five-year-old children. In what follows, I test the noncognitive/behavioral gap in the first five years of life, which is often labeled as the 'critical period' in child development. The purpose of the following descriptive 'skill gap-regressions' is to see (a) at which ages the gap significantly widens, and (b) which parental investment measures explain the gap the most.[58]

I find the largest gap between children who are at least three years old and those who are less, suggesting that the largest widening in the gap happens after the first three years of life. I find that bedtime reading, maternal mental health, and positive parenting practices are more important transmission mechanisms from socio-economic background to behavioral scores than daycare time or maternal work. These results motivate the chosen age range and justify my focus on parental time.

I next describe my empirical strategy for assessing the widening skill gap by age ('skill gap-regressions'). Using a sample of children below the age of 12 in the NLSCY, I estimate the following regression:

$$\begin{aligned} y_i \quad &= \tau_0 + \tau_1 \text{high-educ}_i + \tau_2 \text{high-educ}_i \cdot \text{age}(3-5)_a + \tau_3 \text{high-educ}_i \cdot \text{age}(6-8)_a \\ &\quad + \tau_4 \text{high-educ}_i \cdot \text{age}(9-11)_a + \tau_5 HS_i + \tau'_{6t} + \tau'_{7p} + \tau'_{8a} + \tau'_9 X_i + \iota_i, \end{aligned} \tag{14}$$

where i, t, p, a index household, time, province, and child age, respectively; y is the average age-standardized behavioral score (measured by hyperactivity), high-educ indicates high-educated family, defined as the mother having either some college or university education, $\text{age}(3-5)$, $\text{age}(6-8)$ and $\text{age}(9-11)$ indicate that the child is between three and five, six and eight, and nine and eleven years old, respectively, and HS indicates the mother has, at most, a high school degree. τ_{6t} corresponds to a full set of year dummies, τ_{7p} corresponds to a full set of province dummies, and τ_{8a} corresponds to a full set of child's age dummies. X includes the gender of the child, number of older and younger siblings (capped at 3 and 2, respectively), the size of the household, the mother's and father's age, and the father's education. Standard errors are clustered at the province-post level.

The coefficients of interest are $\tau_1 - \tau_4$, corresponding to the behavioral/developmental human capital gap—also called the noncognitive gap—across age-categories. For instance, τ_1 shows the gap for 0-2 years old children, while $\tau_1 + \tau_2$ shows the gap for 3-5 years old children; thus, τ_2 shows whether the gap significantly

[56] Noncognitive or behavioral skills, such as temperament, persistence, self-discipline, adaptability, reliability, etc., have only recently attracted economists' interest in explaining general educational/labor market outcomes (*e.g.*, Rubinstein and Heckman (2001), Osborne et al. (2001), Heckman et al. (2006), Borghans et al. (2008), Deming (2018)), or labor market returns to particular personality traits (*e.g.*, Osborne (2005)). This research indicates that noncognitive skills play a significant, increasing role in the labor outcome process; *e.g.*, Deming (2018) shows the link between jobs' social skill requirements and wage growth since 1980.

[57] Fryer and Levitt (2004) and Fryer and Levitt (2006) document that the Black-White achievement gap increases on average by 10 percent of a standard deviation per year in the first three grades and rule out genetic differences across races to account for the gap (Fryer and Levitt, 2013). Cunha et al. (2006) and Carneiro et al. (2005) show an 8 and a 6 percentage points increase in the PIAT mathematics score gap between ages 5–13, between children stemming from families in the lowest and highest income quartile, and between Black and White children, respectively. Case et al. (2002) and Currie and Stabile (2003) show the steepening health–status gradient, by age, for the US and Canada. Cunha et al. (2006) document a 4 percentage point increase in the anti-social behavioral score gap between both poor and rich children and between Black and White children between ages 4–12. These gaps disappear when controlling for family structure, maternal education, or maternal ability. No formal test results are shown on the significance/shape of the gap.

[58] Both the quality and quantity of parents' time investments have been shown to be key for child development. For instance, Price and Kalil (2019) find an extra day per month maternal reading increases a child's PIAT reading score by about 8 percent of a standard deviation at ages 5–9. Kalb and van Ours (2014) find that being read to at the age of 4-5 regularly has positive effects on the cognitive skills of children up to an age of 10-11; Fiorini and Keane (2014) find the largest return of educational activities with parents (mother's parenting style) on cognitive (noncognitive) skill development. Hale et al. (2011) find a positive relationship between language-based bedtime routines and sleep duration, general health and verbal test scores, and a negative relationship with anxiety and aggression. Del Bono et al. (2016) find a strong positive relationship between educational/recreational maternal time and cognitive/emotional skill development for ages 3–7, and between parenting style based on routine and discipline and verbal skills, and greater productivity of investments for children of more educated mothers. Using a change in maternity leave entitlements in Norway, Carneiro et al. (2015) find that increased maternal time leads to lower likelihood of dropping out of high school and higher wages.

widens after the first three years of life. I present the estimation results of (14), and assess how the inclusion of parental practices, maternal health, maternal employment, daycare attendance, and parents' reading practices each change the estimated coefficients $\hat{\tau}_1 - \hat{\tau}_4$ one-by-one.

The aim of this solely descriptive exercise is to see through which channel maternal education is most correlated with child development. If, for instance, the estimated coefficients shrink by including parental reading practices, that is an indication of parental reading being an important transmission mechanism between socio-economic background and child development. Recognizing these channels not only helps us to understand which parental investment measures are crucial in shaping the gap, but also helps us to see in which parental investment measures the educational differences matter the most. This approach is similar to controlling for mother's ability, family income, and family structure to see by how much the average anti-social behavior score percentile by income quartile or race is reduced, as chosen by Cunha et al. (2006). This approach is also similar to reporting the 'conditional difference' by Baker and Milligan (2016), that is accomplished by controlling for some observable characteristics after reporting the means of test scores at ages four and five across gender.

The first column in Table C1 shows the estimation result of model (14). There is a significant gap between high- and low-educated parents' children already in their first three years of life (the 'critical period'): 6 percent of a standard deviation of the average age-standardized hyperactivity score in favor of high-status children. That gap then significantly widens to 12.6 percent once children reach five years of age, and further changes in the gap cannot be statistically differentiated from zero (*i.e.*, $H_0 : \alpha_2 = \alpha_3$ and $\alpha_2 = \alpha_4$ can not be rejected).

Table C1: **Documenting the Behavioral Skill Gap between Children of High-Educated and Low-Educated Parents over Ages 0-11**

	controlling for:	*parenting practices*		*maternal health*		*maternal work and care*		
	base	**positive**	**family func.**	**depression**	**1:excellent**	**1:work**	**1:in care**	**1:reading**
τ_1 : high-educ.	-0.0559***	-0.0477**	-0.0390*	-0.0364*	-0.0395**	-0.0553**	-0.0558***	-0.0429***
	(0.0186)	(0.0185)	(0.0189)	(0.0185)	(0.0182)	(0.0203)	(0.0160)	(0.0148)
τ_2 : high-educ.	-0.1261***	-0.1290***	-0.1302***	-0.1274***	-0.1306***	-0.1297***	-0.1257***	-0.1297***
·age(3-5)	(0.0225)	(0.0234)	(0.0223)	(0.0233)	(0.0207)	(0.0202)	(0.0229)	(0.0238)
τ_3 : high-educ.	-0.1049**	-0.1145***	-0.1202***	-0.1232***	-0.1030**	-0.1059**		
·age(6-8)	(0.0399)	(0.0392)	(0.0390)	(0.0380)	(0.0394)	(0.0399)		
τ_4 : high-educ.	-0.1023**	-0.1119**	-0.1176**	-0.1204**	-0.1045**	-0.1027**		
·age(9-11)	(0.0479)	(0.0467)	(0.0472)	(0.0462)	(0.0481)	(0.0486)		
R^2	0.035	0.039	0.038	0.043	0.041	0.035	0.022	0.024
N	104,370	104,370	104,370	104,370	103,232	103,449	71,749	71,749

Note: this table shows the result of estimating the base model (14) on the average age-standardized behavioral score; controlling for a full set of year (or wave), province, child age dummies, the gender of the child, number of older and younger siblings (capped at 3 and 2, respectively), the size of the household, the mother's and father's age, and the father's education. high-educ. indicates high-educated, defined as the mother having either some college, or university education, age$(3-5)$ indicates the child being between 3 and 5 years old. Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: NLSCY waves 1-7 (1994-2006), 0-11 years old children in two-parent families, both parents at most 50 years old.

To see through which channel parental education and child development are most related, additional columns show the estimation result for the same model by adding variables one-by-one. The initial gap is essentially unaffected with the inclusion of maternal work or daycare use, suggesting that these are not key transmission channels through which high-educated parents' children develop better than low-educated parents' children. But, comparing two similar children receiving the same positive parenting practices at home, the disadvantaged child has, on average, worse behavioral outcomes by only 4.8 percent of a standard deviation. Thus, 15 percent of the baseline gap in the critical period is operating through positive parenting practices that are not impacting the gap at later ages. The early childhood gap reduces to 3.6-3.9 percent and becomes significant only at the 10 percent level, once controlling for maternal mental health or family functioning, accounting for $\frac{1}{3}$ of the variation in the hyperactivity score. The early childhood gap reduces to 4.3 (4.77) once controlling for parental reading practices (positive parental practices), accounting for approximately $\frac{1}{4}$ of the variation. Inclusion of any of the parenting, family functioning, maternal health, daycare use, or labor supply measures do not alter by how much the childhood gap widens at later ages.

D Appendix Tables for Reduced-Form Results

Table D1: **Effect of a Daycare Price Decrease on Daycare Use (Extensive Margin); Policy Impact for All and by Education (Data: NLSCY)**

	in institutional care		**care in other's home**		**care in own home**		**in any care**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.184***	0.131***	-0.030***	-0.003	-0.024***	-0.040***	0.131***	0.088***
	(0.0072)	(0.0145)	(0.0037)	(0.0078)	(0.0025)	(0.0072)	(0.0093)	(0.0189)
β_2 : policy		0.070***		-0.034***		0.025***		0.061***
·high-educ		(0.0144)		(0.0116)		(0.0084)		(0.0201)
β_3 : college	0.048***	0.035***	0.084***	0.097***	0.021***	0.034***	0.153***	0.166***
	(0.014)	(0.012)	(0.012)	(0.015)	(0.003)	(0.007)	(0.011)	(0.017)
β_4 : university	0.076***	0.062***	0.066***	0.079***	0.054***	0.067***	0.195***	0.209***
	(0.011)	(0.010)	(0.008)	(0.010)	(0.007)	(0.009)	(0.008)	(0.013)
R^2	0.123	0.124	0.049	0.049	0.022	0.022	0.117	0.117
N	61,962	61,962	61,962	61,962	61,962	61,962	61,962	61,962
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	0.092	0.184	0.238	-0.030	0.108	-0.024	0.437	0.131
low-educ.	0.053	0.131	0.176	-0.003	0.083	-0.040	0.312	0.088
high-educ.	0.106	0.201	0.261	-0.037	0.117	-0.015	0.484	0.141
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: NLSCY waves 1-7 (1994-2006), 0-4 years old children in two-parent families, both parents at most 50 years old. In *Panel B,* for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact, for all and by mother's education. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D2: **Effect of a Daycare Price Decrease on Daycare Use (Intensive Margin); Policy Impact for All and by Education (Data: NLSCY)**

	hours in daycare		**1: hours in daycare>20**	
PanelA: Regression Results				
	(1)	(2)	(3)	(4)
β_1 : policy	5.900***	3.683***	0.160***	0.113***
	(0.2495)	(0.5804)	(0.0080)	(0.0171)
β_2 : policy		3.095***		0.066***
·high-educ		(0.7146)		(0.0198)
R^2	0.118	0.119	0.105	0.105
N	61,962	61,962	61,962	61,962
PanelB: Means and Policy Impacts				
all	12.968	5.900	0.277	0.160
low-ed.	10.349	3.683	0.186	0.113
high-ed.	14.011	6.778	0.311	0.173
PanelC: P-values of Testing Coefficients				
$\beta_1 + \beta_2 = 0$		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: NLSCY waves 1-7 (1994-2006), 0-5 years old children in two-parent families, both parents at most 50 years old. In *Panel B,* for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D3: **Effect of a Daycare Price Decrease on Mother's Working Propensity and Daycare Use; Policy Impact for All and by Education (Data: NLSCY)**

	working&daycare		**not working&daycare**		**working&no-daycare**		**not working&no-daycare**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.105***	0.046**	0.030***	0.049***	-0.029***	-0.004	-0.106***	-0.091***
	(0.0087)	(0.0169)	(0.0012)	(0.0047)	(0.0063)	(0.0072)	(0.0074)	(0.0163)
β_2 : policy		0.083***		-0.025***		-0.035***		-0.023
·high-educ		(0.0185)		(0.0057)		(0.0110)		(0.0179)
β_3 : college	0.161***	0.166***	-0.007	0.000	0.013*	0.010	-0.166***	-0.176***
	(0.014)	(0.018)	(0.005)	(0.003)	(0.007)	(0.010)	(0.009)	(0.014)
β_4 : university	0.198***	0.204***	-0.002	0.006	-0.007	-0.010	-0.189***	-0.200***
	(0.013)	(0.015)	(0.007)	(0.004)	(0.006)	(0.010)	(0.012)	(0.014)
R^2	0.120	0.120	0.021	0.022	0.021	0.021	0.092	0.092
N	61,496	61,496	61,496	61,496	61,496	61,496	61,496	61,496
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	0.395	0.105	0.042	0.030	0.218	-0.029	0.344	-0.106
high-ed.	0.268	0.046	0.044	0.049	0.214	-0.004	0.475	-0.091
low-ed.	0.443	0.129	0.041	0.024	0.220	-0.039	0.295	-0.114
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: NLSCY waves 1-7 (1994-2006), 0-4 years old children in two-parent families, both parents at most 50 years old. In *Panel B,* for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact, for all and by mother's education. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D4: **Effect of a Daycare Price Decrease on Parents' Labor Supply (Extensive and Intensive Margin); Policy Impact for All and by Education (Data: Census)**

	mother working		**mother's hours**		**father working**		**father's hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.055***	0.031**	1.269***	0.659	0.013***	0.002	-0.529***	-1.933***
	(0.0042)	(0.0110)	(0.1647)	(0.4883)	(0.0022)	(0.0086)	(0.1217)	(0.4679)
β_2 : policy		0.025*		0.633		0.010		1.816**
·high-educ		(0.0130)		(0.6188)		(0.0111)		(0.6521)
β_3 : college	0.146***	0.151***	3.712***	3.915***	0.057***	0.065***	2.744***	3.661***
	(0.011)	(0.011)	(0.339)	(0.500)	(0.009)	(0.008)	(0.424)	(0.401)
β_4 : university	0.182***	0.188***	4.806***	5.057***	0.063***	0.073***	2.546***	3.546***
	(0.023)	(0.014)	(0.665)	(0.592)	(0.012)	(0.007)	(0.649)	(0.417)
R^2	0.083	0.084	0.117	0.118	0.041	0.042	0.034	0.035
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	0.622	0.055	17.929	1.269	0.889	0.013	39.975	-0.529
high-educ.	0.494	0.031	14.556	0.659	0.835	0.002	37.596	-1.933
low-educ.	0.683	0.056	19.520	1.292	0.914	0.012	41.097	-0.117
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.002		0.619

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B,* for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact, for all and by mother's education. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D5: **Effect of a Daycare Price Decrease on Mother's Parenting Time; Policy Impact for All and by Education (Data: Census)**

	average		**0-15 hours**		**16-30 hours**		**31-60 hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.870***	0.591**	-0.021***	-0.012***	-0.003*	-0.0060	0.0176***	0.0080**
	(0.1052)	(0.2385)	(0.0010)	(0.0039)	(0.0016)	(0.0039)	(0.0018)	(0.0029)
β_2 : policy		0.677**		-0.015***		0.001		0.0128***
·high-educ		(0.2766)		(0.0052)		(0.0043)		(0.0024)
β_3 : college	1.175***	1.809***	-0.037***	-0.044***	0.015***	0.009***	0.026***	0.024***
	(0.374)	(0.143)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)
β_4 : university	-0.313	0.315*	-0.036***	-0.043***	0.042***	0.037***	0.056***	0.054***
	(0.293)	(0.164)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)
R^2	0.067	0.067	0.023	0.023	0.028	0.028	0.016	0.016
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	44.824	0.870	0.120	-0.021	0.140	-0.003	0.231	0.018
low-educ.	44.409	0.591	0.147	-0.012	0.123	-0.006	0.199	0.008
high-educ.	45.020	1.268	0.107	-0.015	0.149	-0.005	0.246	0.021
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.003		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B*, for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D6: **Effect of a Daycare Price Decrease on Father's Parenting Time; Policy Impact for All and by Education (Data: Census)**

	average		**0-15 hours**		**16-30 hours**		**31-60 hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	0.718***	0.442*	-0.027***	-0.015***	0.011***	0.003	0.019***	0.013***
	(0.1345)	(0.2203)	(0.0026)	(0.0036)	(0.0007)	(0.0015)	(0.0014)	(0.0025)
β_2 : policy		0.485*		-0.019***		0.012***		0.008**
·high-educ		(0.2410)		(0.0040)		(0.0018)		(0.0030)
β_3 : college	1.505***	1.714***	-0.045***	-0.051***	0.025***	0.029***	0.022***	0.019***
	(0.223)	(0.136)	(0.004)	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)
β_4 : university	1.741***	1.947***	-0.071***	-0.077***	0.052***	0.056***	0.040***	0.038***
	(0.108)	(0.248)	(0.005)	(0.006)	(0.003)	(0.001)	(0.004)	(0.004)
R^2	0.019	0.019	0.017	0.017	0.006	0.006	0.007	0.007
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	24.104	0.718	0.447	-0.027	0.255	0.0110	0.167	0.019
low-educ.	23.203	0.442	0.485	-0.015	0.225	0.0026	0.145	0.013
high-educ.	24.530	0.927	0.429	-0.034	0.269	0.0134	0.177	0.021
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_3 = 0$		0.000		0.000		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B*, for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D7: **Effect of a Daycare Price Decrease on Mother's Home Production Time; Policy Impact for All and by Education (Data: Census)**

	average		**0-15 hours**		**16-30 hours**		**31-60 hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	-2.046***	-2.233***	0.053***	0.051***	-0.009***	-0.001	-0.028***	-0.028***
	(0.1295)	(0.2707)	(0.0021)	(0.0043)	(0.0012)	(0.0029)	(0.0009)	(0.0042)
β_2 : policy		0.528		-0.004		-0.010***		0.006
·high-educ		(0.3340)		(0.0056)		(0.0033)		(0.0060)
β_3 : college	-1.232***	-0.793***	0.007	-0.011**	0.031***	0.039***	-0.004	0.006*
	(0.345)	(0.262)	(0.008)	(0.004)	(0.001)	(0.004)	(0.005)	(0.003)
β_4 : university	-4.272***	-3.848***	0.053***	0.035***	0.059***	0.068***	-0.030***	-0.019***
	(0.575)	(0.347)	(0.014)	(0.007)	(0.005)	(0.003)	(0.009)	(0.005)
R^2	0.098	0.099	0.056	0.057	0.008	0.008	0.014	0.015
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	30.523	-2.046	0.296	0.053	0.281	-0.009	0.237	-0.028
low-educ.	32.403	-2.233	0.280	0.051	0.246	-0.001	0.245	-0.028
high-educ.	29.637	-1.805	0.304	0.047	0.297	-0.011	0.234	-0.022
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_2 = 0$		0.000		0.000		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B*, for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

Table D8: **Effect of a Daycare Price Decrease on Father's Home Production Time; Policy Impact for All and by Education (Data: Census)**

	average		**0-15 hours**		**16-30 hours**		**31-60 hours**	
Panel A: Regression Results								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
β_1 : policy	-1.084***	-1.215***	0.036***	0.039***	-0.021***	-0.023***	-0.011***	-0.012***
	(0.0592)	(0.1875)	(0.0013)	(0.0043)	(0.0009)	(0.0020)	(0.0009)	(0.0017)
β_2 : policy		0.278		-0.008		0.005*		0.003
·high-educ		(0.2602)		(0.0059)		(0.0022)		(0.0021)
β_3 : college	0.097	0.106	-0.005	-0.007***	0.015***	0.017***	-0.003	-0.001
	(0.201)	(0.115)	(0.006)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
β_4 : university	-0.451**	-0.456***	0.011	0.009***	0.019***	0.020***	-0.015***	-0.013***
	(0.199)	(0.119)	(0.006)	(0.003)	(0.003)	(0.002)	(0.003)	(0.001)
R^2	0.016	0.016	0.012	0.012	0.004	0.004	0.005	0.005
N	698,490	698,490	698,490	698,490	698,490	698,490	698,490	698,490
Panel B: Means and Policy Impacts								
	mean	*impact*	*mean*	*impact*	*mean*	*impact*	*mean*	*impact*
all	14.115	-1.084	0.695	0.036	0.205	-0.021	0.072	-0.011
low-educ.	14.169	-1.215	0.698	0.039	0.189	-0.023	0.077	-0.012
high-educ.	14.089	-0.935	0.695	0.031	0.213	-0.018	0.070	-0.009
Panel C: P-values of Testing Coefficients								
$\beta_1 + \beta_3 = 0$		0.000		0.000		0.000		0.000

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B*, for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

In the GSS Time Use Diary, respondents are asked to put each minute of their time into mutually exclusive time-use categories, indicating their primary focus of interest. Within 'home production time', I consider: cooking/washing up, housekeeping, maintenance and repair, and shopping for goods and services, other); within 'parenting time', I consider: time spent on baby and child care, helping, teaching, reprimanding, reading/conversation with child, playing with child, medical care of child.

Table D9: **Effect of a Daycare Price Decrease on Father's and Mother's Time Use; Policy Impact for All and by Education (Data: GSS Time Use Diary)**

	mother parenting time		**mother home production time**		**father parenting time**	
Panel A: Regression Results for the Level of Time						
	(1)	(2)	(3)	(4)	(5)	(6)
β_1 : policy	1.493***	-1.008	-0.649	0.339	0.162	-1.828
	(0.4010)	(1.1648)	(0.4227)	(0.9489)	(0.1848)	(1.3935)
β_2 : policy		3.289*		-1.292		3.344**
·high-educ		(1.6850)		(1.1086)		(1.3770)
β_3 : college	-0.707	-0.318	-1.872***	-2.204**	1.152	3.170**
	(0.707)	(1.625)	(0.485)	(0.856)	(0.984)	(1.219)
β_4 : university	-0.505	-0.035	-3.407***	-3.787***	0.926	2.995***
	(1.126)	(1.658)	(0.427)	(0.957)	(0.685)	(0.885)
R^2	0.163	0.164	0.033	0.032	0.039	0.042
N	2,001	2,001	2,001	2,001	1,822	1,822
data	GSS	GSS	GSS	GSS	GSS	GSS
Panel B: Means and Policy Impacts						
	mean	*impact*	*mean*	*impact*	*mean*	*impact*
all	13.122	1.493	16.792	-0.649	6.345	0.162
low-educ.	13.121	-1.008	18.180	0.339	5.408	-1.828
high-educ.	13.123	2.281	16.207	0.953	6.824	1.516
Panel C: P-values of Testing Coefficients						
$\beta_1 + \beta_2 = 0$		0.07		0.056		0.063

Note: *Panel A* shows the result of estimating the Difference-in-Differences models (1) and (2). Standard errors are in parentheses and are clustered at the province-post level. *** p<0.01, ** p<0.05, * p<0.1. Data: GSS (1998,2005,2010), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. In *Panel B,* for each outcome variable, the first column shows the weighted mean in the estimation sample, while the second column shows the estimated policy impact. The *p-values* in *Panel C* correspond to the test $\beta_1 + \beta_2 = 0$.

The following tables show the robustness of the confidence intervals presented previously ('base') to the Wild-bootstrapping method of Cameron et al. (2008), accounting for small number of clusters.

Table D10: **Alternative Confidence Bounds for Selected Outcome Variables in the NLSCY**

1: in institutional care		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.1687	0.1678	0.1669	0.1000	0.1020	0.1028
	upper CI-bound	0.1987	0.1996	0.2004	0.1609	0.1590	0.1560
β_2 : policy·high-educ	lower CI-bound				0.0398	0.0417	0.0435
	upper CI-bound				0.1001	0.0982	0.0959
1: in any care		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.1110	0.1071	0.1097	0.0486	0.0511	0.0533
	upper CI-bound	0.1500	0.1540	0.1523	0.1276	0.1251	0.1219
β_2 : policy·high-educ	lower CI-bound				0.0191	0.0218	0.0345
	upper CI-bound				0.1032	0.1006	0.0880
daycare hours		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	5.3781	5.3481	5.3018	2.4682	2.5454	2.7954
	upper CI-bound	6.4225	6.4525	6.4950	4.8980	4.8208	4.5011
β_2 : policy·high-educ	lower CI-bound				1.5988	1.6939	2.4307
	upper CI-bound				4.5903	4.4953	3.8121
1: mother working		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.0602	0.0552	0.0574	0.0075	0.0097	0.0102
	upper CI-bound	0.0916	0.0967	0.0936	0.0762	0.0740	0.0742
β_2 : policy·high-educ	lower CI-bound				0.0108	0.0131	0.0180
	upper CI-bound				0.0853	0.0830	0.0764
1: read often		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.0288	0.0292	0.0270	0.0161	0.0177	0.0212
	upper CI-bound	0.0421	0.0417	0.0427	0.0679	0.0662	0.0628
β_2 : policy·high-educ	lower CI-bound				-0.0530	-0.0503	-0.0403
	upper CI-bound				0.0306	0.0280	0.0188
1: read weekly		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.0158	0.0141	0.0158	-0.0102	-0.0094	-0.0036
	upper CI-bound	0.0229	0.0246	0.0231	0.0160	0.0152	0.0099
β_2 : policy·high-educ	lower CI-bound				0.0062	0.0072	0.0157
	upper CI-bound				0.0382	0.0372	0.0288

Table D11: **Alternative Confidence Bounds for Selected Outcome Variables in the Census**

1: mother working		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.0457	0.0457	0.0454	0.0077	0.0092	0.0127
	upper CI-bound	0.0634	0.0634	0.0638	0.0538	0.0523	0.0484
β_2 : policy·high-educ	lower CI-bound				-0.0019	-0.0002	0.0103
	upper CI-bound				0.0526	0.0508	0.0405
mother's avg. parenting time		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.6502	0.6716	0.6230	0.0921	0.1239	0.0786
	upper CI-bound	1.0905	1.0691	1.1378	1.0904	1.0586	1.1017
β_2 : policy·high-educ	lower CI-bound				0.0978	0.1346	0.3506
	upper CI-bound				1.2556	1.2188	0.9870
mother's avg. home production time		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	-2.3167	-2.3098	-2.3481	-2.7992	-2.7631	-2.5651
	upper CI-bound	-1.7745	-1.7815	-1.7503	-1.6659	-1.7019	-1.9359
β_2 : policy·high-educ	lower CI-bound				-0.1713	-0.1268	0.3290
	upper CI-bound				1.2269	1.1824	0.7118
father's avg. parenting time		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.4364	0.4075	0.3876	-0.0191	0.0101	-0.0200
	upper CI-bound	0.9996	1.0285	1.0579	0.9029	0.8736	0.8659
β_2 : policy·high-educ	lower CI-bound				-0.0199	0.0121	0.2398
	upper CI-bound				0.9889	0.9568	0.7350

Table D12: **Alternative Confidence Bounds for Selected Outcome Variables in the GSS**

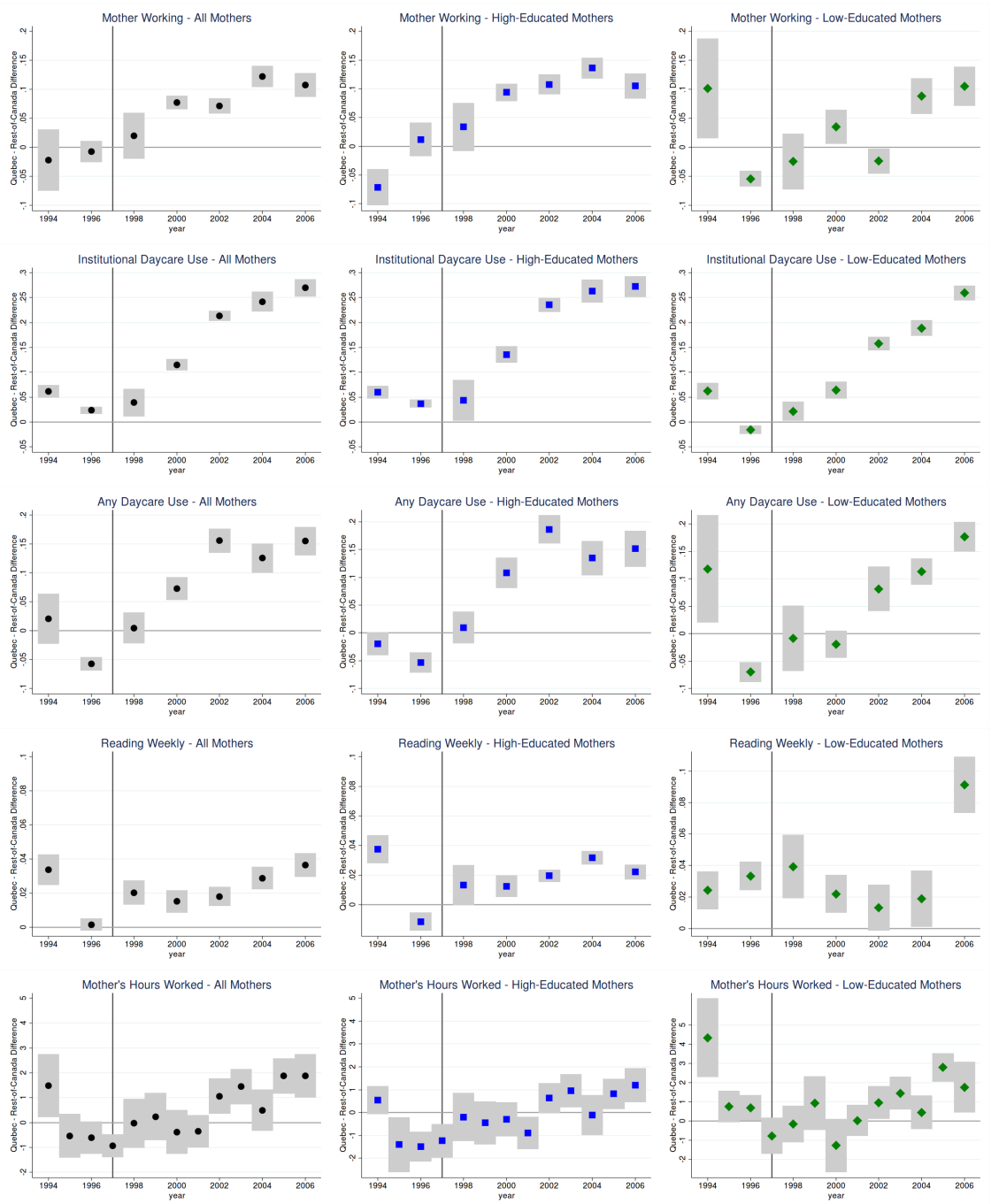
mother's parenting time		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.6535	0.6765	0.5876	-3.4460	-3.2946	-2.3507
	upper CI-bound	2.3320	2.3090	2.3643	1.4297	1.2783	0.4096
β_2 : policy·high-educ	lower CI-bound				-0.2383	-0.0192	1.2321
	upper CI-bound				6.8154	6.5963	5.4704
mother's home production time		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	-1.5339	-1.7254	-1.6949	-1.6473	-1.5239	-1.6445
	upper CI-bound	0.2354	0.4269	0.3618	2.3247	2.2014	2.1988
β_2 : policy·high-educ	lower CI-bound				-3.6127	-3.4686	-2.8004
	upper CI-bound				1.0279	0.8838	0.4120

Table D13: **Alternative Confidence Bounds for Selected Outcome Variables in the LFS**

1: mother working		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.0221	0.0215	0.0201	-0.0037	-0.0028	-0.0001
	upper CI-bound	0.0448	0.0454	0.0462	0.0239	0.0230	0.0196
β_2 : policy·high-educ	lower CI-bound				0.0083	0.0095	0.0156
	upper CI-bound				0.0476	0.0464	0.0397
mother hours		*base*	*CGM*	*wild-boot*	*base*	*CGM*	*wild-boot*
β_1 : policy	lower CI-bound	0.7216	0.7188	0.6948	-0.0482	-0.0188	0.1259
	upper CI-bound	1.4401	1.4429	1.4518	0.8767	0.8473	0.6867
β_2 : policy·high-educ	lower CI-bound				0.0017	0.0497	0.5146
	upper CI-bound				1.5111	1.4632	1.0029

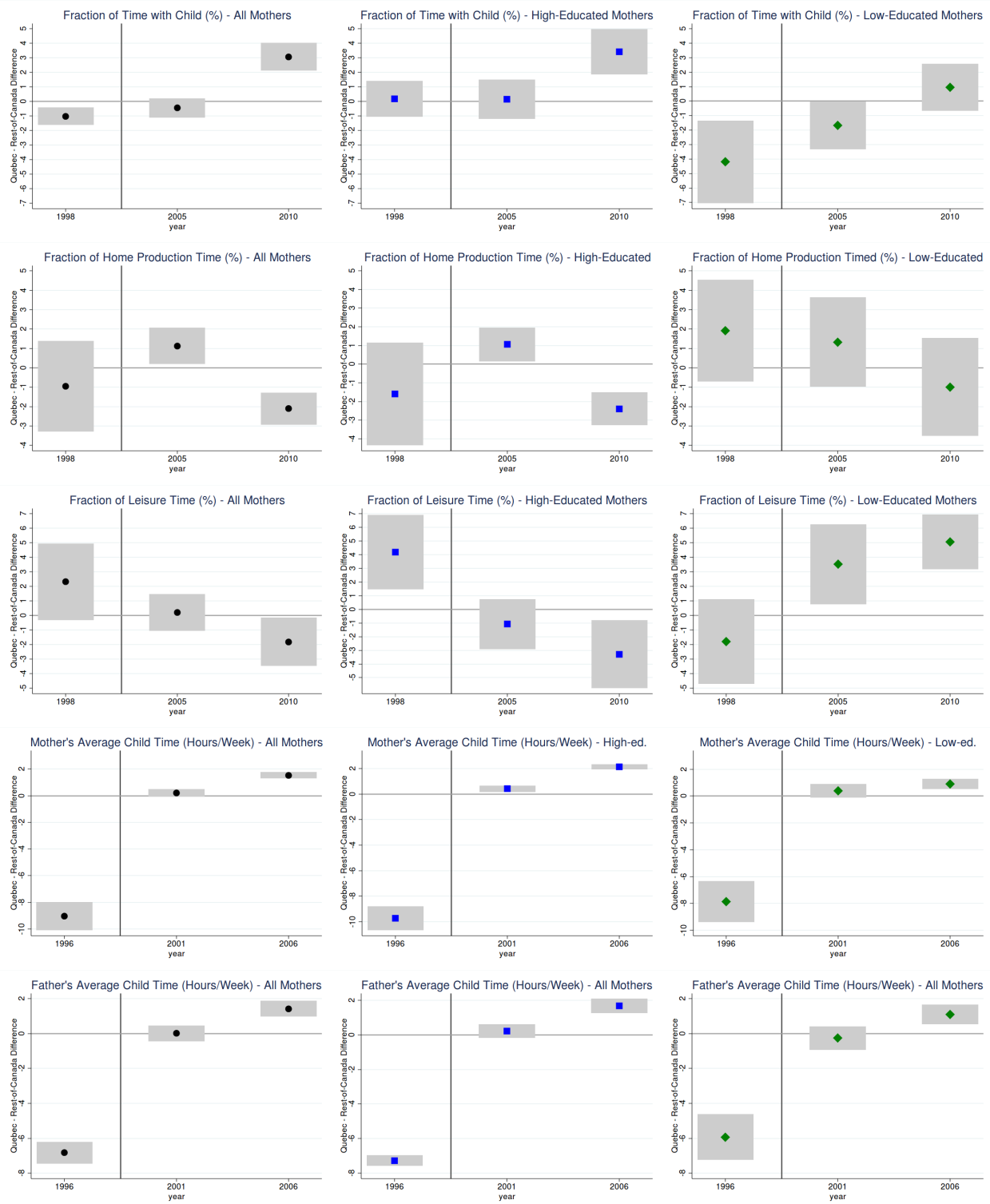
E Appendix Figures for Reduced-Form Results

Figure E1: **Estimated Difference between Québec and the Rest-of-Canada Across Years, with a 95% Confidence Band, for All and by Education (Data: NLSCY)**



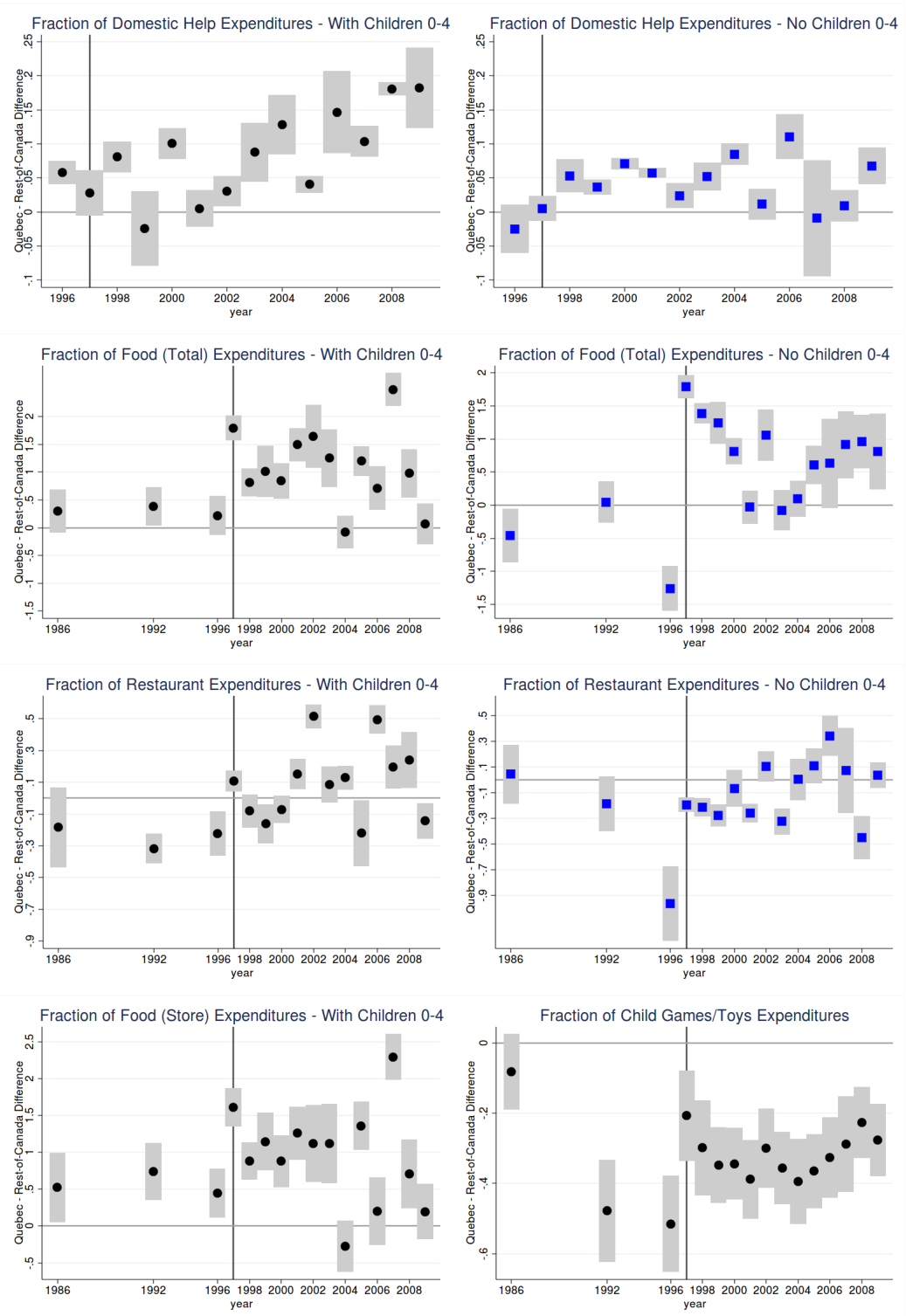
Note: these graphs show the estimated difference between Québec and the Rest-of-Canada across years for various outcomes, with a 95% confidence band, stemming from a variant of model (1). In these models, instead of interacting the eligibility-by-cohort indicator variable with indicator variable for Québec, year-indicators are interacted with the variable indicating residence in Québec. Standard errors are clustered at the province-post level. Data: NLSCY waves 1-7 (1994-2006) and LFS (1994-2006), 0-4 years old children in two-parent families, both parents at most 50 years old. The vertical line shows the year of 1997, when the policy was introduced.

Figure E2: **Estimated Difference between Québec and the Rest-of-Canada Across Years, with a 95% Confidence Band, for All and by Education (Data: GSS Time-Use Diary and Census)**



Note: these graphs show the estimated difference between Québec and the Rest-of-Canada across years for various outcomes, with a 95% confidence band, stemming from a variant of model (1). In these models, instead of interacting the eligibility-by-cohort indicator variable with indicator variable for Québec, year-indicators are interacted with the variable indicating residence in Québec. Standard errors are clustered at the province-post level. Data: Census (1996,2001,2006) and GSS (1998,2005,2010), two-parent families with at least one 0-4 years old child, both parents at most 50 years old. The vertical line shows the year of 1997, when the policy was introduced. In the GSS, 1998 is considered the pre-policy year, due to data limitations.

Figure E3: **Estimated Difference between Québec and the Rest-of-Canada Across Years, with a 95% Confidence Band, for All and by Having Children Aged 0-4 (Data: SHS)**



Note*:* these graphs show the estimated difference between Québec and the Rest-of-Canada across years for various outcomes, with a 95% confidence band, stemming from a variant of model (1). In these models, instead of interacting the eligibility-by-cohort indicator variable with indicator variable for Québec, year-indicators are interacted with the variable indicating residence in Québec. Standard errors are clustered at the province-post level. Data: SHS (1986,1992,1996-2009), two-parent families with and without at least one 0-4 years old child, both parents at most 50 years old. The vertical line shows the year of 1997, when the policy was introduced.

F Appendix: Solving the Household Problem

I consider a unitary model of the household which derives utility from three commodities—child human capital K, home production goods H, and leisure goods L—according to the following Cobb-Douglas utility function:

$$U = \beta_K \log K + \beta_H \log H + \beta_L \log L.$$

The household has one child and I abstract from fertility decisions and bargaining between the parents.

Commodities K, H, and L are produced from time T and market good X with the following Constant Elasticity of Substitution (CES) production functions, where ρ_j is the substitution parameter between T and X and γ_j is the time productivity parameter, for $j = K, H, L$, and K_0 is initial child human capital:

$$K = \left([(\gamma_K T_K)^{\rho_K} + X_K^{\rho_K}]^{\frac{1}{\rho_K}} \right)^{K_0} \; ; \; H = [(\gamma_H T_H)^{\rho_H} + X_H^{\rho_H}]^{\frac{1}{\rho_H}} \; ; \; L = [(\gamma_L T_L)^{\rho_L} + X_L^{\rho_L}]^{\frac{1}{\rho_L}} .$$

The market goods for producing child human capital K—in short, "child market goods"—comprise of child books, toys and games, B, and time spent in daycare D. The time spent on producing K—in short, "parenting time"—comprise of child time spent by the mother (denoted by T_K^M) and by the father (denoted by T_K^F).

The household buys daycare D, at the price of m, while the parents work, and also buys market goods B, X_H, and X_L at the price of 1. Mothers and fathers supply T_W^M and T_W^F amount of time on the labor market, and earn w^M and w^F for an hour of work, respectively, and have no non-labor income.

Regarding the constraints on households, I assume that (i) parents use daycare during their average working hours (*i.e.*, $D = \frac{1}{2}\left(T_W^M + T_W^F\right)$), and that (ii) there is no overlap between time-use categories (*e.g.*, during home production, the child might be around the parents, but is not the primary focus of their attention) and there is $\bar{T}$ amount of total time available to each parent; note that (i) allows for the mother not working—so that daycare is paid solely by the father's labor income. In sum, the household faces the following constraints:

1. (*daycare constraint*): $D = \frac{1}{2}\left(T_W^M + T_W^F\right)$;
2. (*budget constraint*): $mD + B + X_H + X_L = w^M T_W^M + w^F T_W^F$;
3. (*time constraint of the mother*): $T_K^M + T_H^M + T_L^M + T_W^M = \bar{T}$;
4. (*time constraint of the father*): $T_K^F + T_H^F + T_L^F + T_W^F = \bar{T}$.

Incorporating constraints 1., 3., and 4., and denoting $w^i - \frac{1}{2}m$ the opportunity cost of time of parent i in a non-work activity, the budget constraint (2.) can be re-written as:

$$B + X_H + X_L + \sum_{i=M,F} \left[\left(w^i - \frac{1}{2}m \right) T_K^i + \left(w^i - \frac{1}{2}m \right) T_H^i + \left(w^i - \frac{1}{2}m \right) T_L^i \right] = \sum_{i=M,F} \left(w^i - \frac{1}{2}m \right) \bar{T}.$$

Defining $I \equiv \sum_{i=M,F} \left(w^i - \frac{1}{2}m \right) \bar{T}$, and denoting the Lagrange multiplier by μ, the *Lagrangean* is:

$$\begin{aligned} \mathcal{L} \;=\; & \frac{\beta_K K_0}{\rho_K} log\left((\gamma_K T_K)^{\rho_K} + X_K^{\rho_K} \right) + \frac{\beta_H}{\rho_H} log\left((\gamma_H T_H)^{\rho_H} + X_H^{\rho_H} \right) + \frac{\beta_L}{\rho_L} log\left((\gamma_L T_L) + X_L^{\rho_L} \right) \\ + \; & \mu \left(I - \sum_{i=M,F} \left[\left(w^i - \frac{1}{2}m \right) T_K^i + \left(w^i - \frac{1}{2}m \right) T_H^i + \left(w^i - \frac{1}{2}m \right) T_L^i \right] - (B + X_H + X_L) \right). \end{aligned}$$

First-Order Conditions (FOC's) with respect to K-related variables

Before taking the *FOC*'s with respect to T_K^i and B, I make the following functional form assumptions: (a) $T_K = \left(T_K^M\right)^{\frac{1}{2}} \left(T_K^F\right)^{\frac{1}{2}}$ and (b) $X_K = (B)^{\frac{1}{2}} (QD)^{\frac{1}{2}}$, where Q is daycare quality. Assumption (a) is supported by Del Boca et al. (2014), who find that the parents' time in child skill formation is equally productive at the youngest ages, so that maternal and paternal time have equal Cobb-Douglas weights, and (b) is a simplifying assumption to keep the focus on the substitutability between X_K and T_K.

Taking the FOC with respect to T_K^M yields:

$$\left(\frac{\beta_K K_0}{\rho_K}\right)\frac{\rho_K\gamma_K^{\rho_K}\left(T_K\right)^{\rho_K-1}\frac{1}{2}\left(T_K^M\right)^{-\frac{1}{2}}\left(T_K^F\right)^{\frac{1}{2}}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}=\mu\left(w^M-\frac{1}{2}m\right). \tag{15}$$

Similarly, taking the FOC with respect to T_K^F yields:

$$\left(\frac{\beta_K K_0}{\rho_K}\right)\frac{\rho_K\gamma_K^{\rho_K}\left(T_K\right)^{\rho_K-1}\frac{1}{2}\left(T_K^F\right)^{-\frac{1}{2}}\left(T_K^M\right)^{\frac{1}{2}}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}=\mu\left(w^F-\frac{1}{2}m\right). \tag{16}$$

Dividing (15) by (16) yields that in optimum, the ratio of marginal utilities (MU's) with respect to T_K^M and T_K^F is equal to the ratio of their prices (or opportunity costs); rearranging for T_K^F and substituting back into $T_K=\left(T_K^M\right)^{\frac{1}{2}}\left(T_K^F\right)^{\frac{1}{2}}$ yields T_K^i as a function of T_K and relative wages:

$$\frac{T_K^F}{T_K^M}=\frac{w^M-\frac{1}{2}m}{w^F-\frac{1}{2}m}\text{ or }T_K^F=T_K^M\left(\frac{w^M-\frac{1}{2}m}{w^F-\frac{1}{2}m}\right)\rightarrow T_K^M=\underbrace{\left(\frac{w^F-\frac{1}{2}m}{w^M-\frac{1}{2}m}\right)^{\frac{1}{2}}}_{\equiv\theta_K}T_K\text{ and }T_K^F=\frac{1}{\theta_K}T_K. \tag{17}$$

Thus, according to (17), in optimum, the "expenditures" on T_K^M and T_K^F are equal, and T_K^i's are proportional to T_K (where θ_K is a function of parents' relative opportunity costs of time and relative wages) with an exponent of $\frac{1}{2}$—this is due to the functional form assumption and the equal Cobb-Douglas weights assumed in T_K.

Next, taking the FOC with respect to B yields:

$$\left(\frac{\beta_K K_0}{\rho_K}\right)\frac{\rho_K\left(X_K\right)^{\rho_K-1}\frac{1}{2}\left(B\right)^{-\frac{1}{2}}\left(QD\right)^{\frac{1}{2}}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}=\mu\text{ or }\left(\frac{\beta_K K_0}{\rho_K}\right)\frac{\rho_K\left(X_K\right)^{\rho_K-1}\frac{1}{2}\frac{X_K}{B}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}=\mu. \tag{18}$$

Given the Cobb-Douglas assumption on $X_K=\left(B\right)^{\frac{1}{2}}\left(QD\right)^{\frac{1}{2}}$, in optimum it also has to be true that the ratio of marginal utilities (MU's) with respect to B and D is equal to the ratio of their prices, the expenditures on B and D are equal, and B and D are proportional to X_K (where α is a function of relative prices and Q). Using that in optimum, $mD=B$ and the functional form assumption on X_K, $\frac{X_K}{B}=\frac{1}{\alpha}$, where $\alpha=\left(\frac{m}{Q}\right)^{\frac{1}{2}}$.
Then, inserting the previous results in (15) and (18) yield:

$$\text{(i)}\frac{1}{2}\beta_K K_0\frac{\gamma_K^{\rho_K}T_K^{\rho_K-1}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}\frac{1}{\theta_K}=\mu\left(w^M-\frac{1}{2}m\right)\text{ and (ii) }\frac{1}{2}\beta_K K_0\frac{X_K^{\rho_K-1}}{\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}}\frac{1}{\alpha}=\mu. \tag{19}$$

From (ii) in (19),

$$\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}=\frac{1}{2}\frac{\beta_K K_0}{\alpha\mu}X_K^{\rho_K-1}\text{ or} \tag{20}$$

$$\frac{\gamma_K T_K}{X_K}=\left(\frac{1}{2}\frac{\beta_K K_0}{\alpha\mu}X_K^{-1}-1\right)^{\frac{1}{\rho_K}}. \tag{21}$$

From (i) in (19),

$$\mu\theta_K\left(w^M-\frac{1}{2}m\right)\left[\left(\gamma_K T_K\right)^{\rho_K}+X_K^{\rho_K}\right]=\frac{1}{2}\beta_K K_0\gamma_K^{\rho_K}T_K^{\rho_K-1}. \tag{22}$$

Combining (20) and (22) yields

$$\frac{\gamma_K T_K}{X_K}=\left(\frac{\left(w^M-\frac{1}{2}m\right)\theta_K}{\alpha\gamma_K}\right)^{\frac{1}{\rho_K-1}}. \tag{23}$$

Substituting (21) into (23) yields the expression for X_K solely as a function of the Lagrange multiplier μ and

parameters:

$$X_K = \frac{1}{2}\frac{\beta_K K_0}{\alpha\mu}\cdot\frac{1}{1+\psi_K},\ \text{where}\ \psi_K = \left(\frac{\theta_K\left(w^M-\frac{1}{2}m\right)}{\alpha\gamma_K}\right)^{\frac{\rho_K}{\rho_K-1}}. \tag{24}$$

By combining (24) and (21), T_K can also be also expressed solely as a function of μ and parameters:

$$\gamma_K T_K = \frac{\beta_K K_0}{\alpha\mu}\cdot\frac{\left(\frac{\theta_K(w-m)}{\alpha\gamma_K}\right)^{\frac{1}{\rho_K-1}}}{1+\psi_K} \rightarrow T_K = \frac{1}{2}\frac{\beta_K K_0}{\mu}\cdot\frac{1}{\theta_K\left(w^M-\frac{1}{2}m\right)}\cdot\frac{\psi_K}{1+\psi_K}. \tag{25}$$

First-Order Conditions (FOC's) with respect to H-related variables
Before taking the *FOC*'s with respect to T_H^i, I make the following functional form assumption for T_H: $T_H = \left(T_H^M\right)^{\lambda_H}\left(T_H^F\right)^{1-\lambda_H}$; *i.e.*, I assume that T_H is a Cobb-Douglas function of T_H^M and T_H^F (which parents know), with general weights λ_H and $1-\lambda_H$, respectively (of which the exact value parents do not know).

Taking the *FOC* with respect to T_H^M yields:

$$\left(\frac{\beta_H}{\rho_H}\right)\frac{\rho_H\gamma_H^{\rho_H}\left(T_H\right)^{\rho_H-1}\lambda_H\left(T_H^M\right)^{\lambda_H-1}\left(T_H^F\right)^{1-\lambda_H}}{\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}} = \mu\left(w^M-\frac{1}{2}m\right). \tag{26}$$

Similarly, taking the *FOC* with respect to T_H^F yields:

$$\left(\frac{\beta_H}{\rho_H}\right)\frac{\rho_H\gamma_H^{\rho_H}\left(T_H\right)^{\rho_H-1}\left(1-\lambda_H\right)\left(T_H^M\right)^{\lambda_H}\left(T_H^F\right)^{-\lambda_H}}{\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}} = \mu\left(w^F-\frac{1}{2}m\right). \tag{27}$$

Dividing (26) by (27) yields that in optimum, the ratio of marginal utilities (*MU*'s) with respect to T_H^M and T_H^F is equal to the ratio of their prices (or opportunity costs); rearranging for T_H^F and substituting back into $T_H = \left(T_H^M\right)^{\lambda_H}\left(T_H^F\right)^{1-\lambda_H}$ yields T_H^i as a function of T_H and relative wages and λ_H:

$$\frac{\lambda_H}{1-\lambda_H}\frac{T_H^F}{T_H^M} = \frac{w^M-\frac{1}{2}m}{w^F-\frac{1}{2}m}\ \text{or}\ T_H^F = \frac{1-\lambda_H}{\lambda_H}T_H^M\left(\frac{w^M-\frac{1}{2}m}{w^F-\frac{1}{2}m}\right) \rightarrow T_H^M = \underbrace{\left(\frac{\lambda_H}{1-\lambda_H}\frac{w^F-\frac{1}{2}m}{w^M-\frac{1}{2}m}\right)^{1-\lambda_H}}_{\equiv\theta_H}T_H. \tag{28}$$

Thus, in optimum, the weighted "expenditures" on T_H^M and T_H^F are equal, and T_H^i's are proportional to T_H (where θ_H is a function of parents' relative opportunity costs of time, relative wages, and the weight λ_H).

Next, taking the *FOC* with respect to X_H yields:

$$\left(\frac{\beta_H}{\rho_H}\right)\frac{\rho_H\left(X_H\right)^{\rho_H-1}}{\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}} = \mu. \tag{29}$$

Then, inserting the previous results in (26) and (29) yield:

$$\text{(i)}\beta_H\lambda_H\frac{\gamma_H^{\rho_H}T_H^{\rho_H-1}}{\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}}\frac{1}{\theta_H} = \mu\left(w^M-\frac{1}{2}m\right)\ \text{and (ii)}\ \beta_H\frac{X_H^{\rho_H-1}}{\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}} = \mu. \tag{30}$$

From (ii) in (30),

$$\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H} = \frac{\beta_H}{\mu}X_H^{\rho_H-1}\ \text{or} \tag{31}$$

$$\frac{\gamma_H T_H}{X_H} = \left(\frac{\beta_H}{\mu}X_H^{-1}-1\right)^{\frac{1}{\rho_H}}. \tag{32}$$

From (i) in (30),

$$\mu\theta_H\left(w^M-\frac{1}{2}m\right)\left[\left(\gamma_H T_H\right)^{\rho_H}+X_H^{\rho_H}\right] = \beta_H\lambda_H\gamma_H^{\rho_H}T_H^{\rho_H-1}. \tag{33}$$

Combining (31) and (33) yields

$$\frac{\gamma_H T_H}{X_H} = \left(\frac{\theta_H \left(w^M - \frac{1}{2} m \right)}{\lambda_H \gamma_H} \right)^{\frac{1}{\rho_H - 1}}. \tag{34}$$

Substituting (32) into (34) yields the expression for home production goods X_H solely as a function of the Lagrange multiplier μ and parameters:

$$X_H = \frac{\beta_H}{\mu} \cdot \frac{1}{1 + \psi_H}, \text{ where } \psi_H = \left(\frac{\theta_H \left(w^M - \frac{1}{2} m \right)}{\lambda_H \gamma_H} \right)^{\frac{\rho_H}{\rho_H - 1}}. \tag{35}$$

By combining (35) and (32), home production time T_H can also be also expressed solely as a function of the Lagrange multiplier μ and parameters:

$$\gamma_H T_H = \frac{\beta_H}{\mu} \cdot \frac{\left(\frac{\theta_H \left(w^M - \frac{1}{2} m \right)}{\lambda_H \gamma_H} \right)^{\frac{1}{\rho_K - 1}}}{1 + \psi_H} \rightarrow T_H = \frac{\lambda_H \beta_H}{\mu} \cdot \frac{1}{\theta_H \left(w^M - \frac{1}{2} m \right)} \cdot \frac{\psi_H}{1 + \psi_H}. \tag{36}$$

Following the same steps for X_L, T_L^M and T_L^F, one arrives at the following optimal demands for leisure market goods and leisure time as a function of μ and parameters:

$$X_L = \frac{\beta_L}{\mu} \cdot \frac{1}{1 + \psi_L} \text{ and } T_L = \frac{\lambda_L \beta_L}{\mu} \cdot \frac{1}{\theta_L \left(w^M - \frac{1}{2} m \right)} \cdot \frac{\psi_L}{1 + \psi_L}, \tag{37}$$

where $\psi_L = \left(\frac{\theta_L \left(w^M - \frac{1}{2} m \right)}{\lambda_L \gamma_L} \right)^{\frac{\rho_L}{\rho_L - 1}}$ and $\theta_L = \left(\frac{\lambda_L}{1 - \lambda_L} \frac{w^F - \frac{1}{2} m}{w^M - \frac{1}{2} m} \right)^{1 - \lambda_L}$.

Substituting (24), (25), (36), and (37) back into the budget constraint yields an expression of μ:

$$\mu = \frac{\beta_K K_0 \left(1 - \frac{1}{2} \frac{1}{1 + \psi_K} \right) + \beta_H + \beta_L}{I}, \text{ where } I \equiv \left(w^M - \frac{1}{2} m \right) \bar{T} + \left(w^F - \frac{1}{2} m \right) \bar{T}. \tag{38}$$

As a last-but-one step, (24), (25), and (38) determine T_K^{M*}, T_K^{F*},B^* and D^*. Lastly, substituting these into the four constraints yields 4 equations with 4 unknowns (T_W^M, T_W^F,λ_H, and λ_L):

1. (*daycare constraint*): $D^* = \frac{1}{2} \left(T_W^M + T_W^F \right)$;
2. (*budget constraint*): $mD^* + B^* + X_H + X_L = w^M T_W^M + w^F T_W^F$;
3. (*time constraint of the mother*): $T_K^{M*} + T_H^M + T_L^M + T_W^M = \bar{T}$;
4. (*time constraint of the father*): $T_K^{F*} + T_H^F + T_L^F + T_W^F = \bar{T}$.

Note that optimal choices X_K^* and T_K^* depend on schooling through five channels:

1. all else equal, high-educated parents' time is allowed to (perceived to) be differentially productive in child skill formation (through γ_K; "time productivity channel");
2. all else equal, parents' preference for child human capital is allowed to differ across education groups (through β_K; "preference channel");
3. all else equal, high-educated parents' time is allowed to (perceived to) be differentially substitutable with market goods (through ρ_K; "substitutability channel");
4. all else equal (including γ_K, β_K, ρ_K and K_0), high-educated parents' wage (thus, the opportunity cost of their time spent with the child) is higher ("wage channel");
5. all else equal, high-educated parents might have children with higher birth weight, and thus higher initial level of child human capital (through K_0; "birth weight channel").

G Appendix: Comparative Statics for the Marshallian Demands

To simplify notation, let $\psi_K \equiv \left(\frac{\theta_K\left(w-\frac{1}{2}m\right)}{\alpha\gamma_K}\right)^{\frac{\rho_K}{\rho_K-1}}$. For signing the various parts below, I assume that $\frac{dw}{dS} > 0$, $\frac{d\gamma_K}{dS} > 0$, $\frac{d\rho_K}{dS} < 0$, $\frac{d\beta_K}{dS} > 0$, and $\frac{dW}{dS} > 0$, but in the structural estimation I estimate and empirically confirm these relationships. To simplify exposition, and without loss of generality, I consider the case in which $w^M = w^F \equiv w$ (implying that $\theta_K = 1$ and $I = 2\left(w-m\right)\bar{T}$, and in which $\beta_K K_0\left(1-\frac{1}{2}\frac{1}{1+\psi_K}\right)+\beta_H+\beta_L$ is a constant ($\equiv \bar{C}$). With these assumptions, the Marshallian demands become:

$$X_K^* = \frac{\frac{\beta_K K_0}{\bar{C}}\left(w-\frac{1}{2}m\right)\bar{T}}{\left(\frac{m}{Q}\right)^{\frac{1}{2}}}\cdot\frac{1}{1+\psi_K} \quad \text{and} \quad T_K^* = \frac{\beta_K K_0}{\bar{C}}\bar{T}\cdot\frac{\psi_K}{1+\psi_K}. \tag{39}$$

/Note for further derivations: $\frac{\partial\psi_K}{\partial w} = \left(\frac{\rho_K}{\rho_k-1}\right)\frac{\psi_K}{\left(w-\frac{1}{2}m\right)}$, $\frac{\partial\psi_K}{\partial\gamma_K} = \left(\frac{\rho_K}{1-\rho_k}\right)\frac{\psi_K}{\gamma_K}$, $\frac{\partial\psi_K}{\partial\rho_K} = \psi_K log\left(\frac{w-\frac{1}{2}m}{\alpha\gamma_K}\right)\left(\frac{-1}{(\rho_K-1)^2}\right)$./

1. How do the Marshallian demands for child market goods depend on schooling?

First, I totally differentiate the optimal choices X_K^* with respect to schooling S, and decompose $\frac{dX_K^*}{dS}$ into (1) the wage channel $\frac{\partial X_K^*}{\partial w}\frac{dw}{dS}$, (2) the time productivity channel $\frac{\partial X_K^*}{\partial\gamma_K}\frac{d\gamma_K}{dS}$, (3) the substitutability channel $\frac{\partial X_K^*}{\partial\rho_K}\frac{d\rho_K}{dS}$, (4) the preference channel $\frac{\partial X_K^*}{\partial\beta_K}\frac{d\beta_K}{dS}$, and (5) the birth weight channel $\frac{\partial X_K^*}{\partial W}\frac{dW}{dS}$.

Wage Channel: the partial derivative with respect to w is positive, irrespective of the sign of ρ_K :

$$\frac{\partial X_K^*}{\partial w} = \frac{\frac{\beta_K K_0}{\bar{C}}\bar{T}}{\alpha\left(1+\psi_K\right)^2}\left(1+\psi_K\left(\frac{1}{1-\rho_K}\right)\right) > 0.$$

Time productivity Channel: the partial derivative with respect to γ_K is positive if $\rho_K < 0$ (*i.e.*, if time and market goods are complements in child human capital production):

$$\frac{\partial X_K^*}{\partial\gamma_K} = \frac{\frac{\beta_K K_0}{\bar{C}}\left(w-\frac{1}{2}m\right)\bar{T}\psi_K}{\alpha\left(1+\psi_K\right)^2\gamma_K}\left(\frac{\rho_K}{\rho_K-1}\right) > 0 \text{ if } \rho_K < 0.$$

Substitutability Channel: the partial derivative with respect to ρ_K is positive:

$$\frac{\partial X_K^*}{\partial\rho_K} = \frac{\frac{\beta_K K_0}{\bar{C}}\left(w-\frac{1}{2}m\right)\bar{T}\psi_K}{\alpha\left(1+\psi_K\right)^2}\left(\frac{log\left(\frac{w-\frac{1}{2}m}{\alpha\gamma_K}\right)}{\left(\rho_K-1\right)^2}\right) > 0.$$

Preference Channel: the partial derivative with respect to β_K is positive:

$$\frac{\partial X_K^*}{\partial\beta_K} = \frac{\frac{K_0}{\bar{C}\alpha}\left(w-\frac{1}{2}m\right)\bar{T}}{1+\psi_K} > 0.$$

birth weight Channel: the partial derivative with respect to K_0 is positive:

$$\frac{\partial X_K^*}{\partial W} = \frac{\frac{\beta_K}{\bar{C}\alpha}\left(w-\frac{1}{2}m\right)\bar{T}}{1+\psi_K} > 0.$$

Thus, high-educated parents will spend more on child market goods through the wage channel, the time productivity channel (if $\rho_K < 0$) and the preference and birth weight channels, but less through the substitution channel (note that higher ρ_K indicates larger degree of substitutability and lower degree of complementarity, which likely hold for low-educated parents). Note that given the partial derivative with respect to $\bar{w}$ is positive, higher-wage parents will buy more of any of the market goods, irrespective of the sign of ρ, all else equal.

2. How do the Marshallian demands for time spent with the child depend on schooling?

Similarly to before, I totally differentiate T_K^*, with respect to S, and perform the decomposition.

Wage Channel: the partial derivative with respect to w is positive, if $\rho_K < 0$:

$$\frac{\partial T_K^*}{\partial w} = \frac{\frac{\beta_K K_0}{\bar{C}} \bar{T}}{(1+\psi_K)^2} \left(\frac{\rho_K}{\rho_K - 1}\right) \frac{\psi_K}{w - \frac{1}{2}m} > 0 \text{ if } \rho_K < 0.$$

Time productivity Channel: the partial derivative with respect to γ_K is negative if $\rho_K < 0$:

$$\frac{\partial T_K^*}{\partial \gamma_K} = \frac{\frac{\beta_K K_0}{\bar{C}} \bar{T}}{(1+\psi_K)^2} \left(\frac{\rho_K}{1 - \rho_K}\right) \frac{\psi_K}{\gamma_K} < 0 \text{ if } \rho_K < 0.$$

Substitutability Channel: the partial derivative with respect to ρ_K is negative:

$$\frac{\partial T_K^*}{\partial \rho_K} = \frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \psi_K}{(1+\psi_K)^2} \cdot \frac{-log\left(\frac{w - \frac{1}{2}m}{\alpha \gamma_K}\right)}{(\rho_K - 1)^2} < 0.$$

Preference Channel: the partial derivative with respect to β_K is positive:

$$\frac{\partial T_K^*}{\partial \beta_K} = \frac{\frac{K_0}{\bar{C}} \bar{T} \psi_K}{1+\psi_K} > 0.$$

birth weight Channel: the partial derivative with respect to K_0 is positive:

$$\frac{\partial T_K^*}{\partial \beta_K} = \frac{\frac{\beta_K}{\bar{C}} \bar{T} \psi_K}{1+\psi_K} > 0.$$

Thus, high-educated parents will spend more time with their children through the wage channel (if $\rho_K < 0$), the preference channel, the birth weight channel, and the substitution channel (note that lower ρ_K indicates larger degree of complementarity and lower degree of substitutability, which likely hold for high-educated parents), but less through the time productivity channel. High-educated parents' more time spent with their children indicates that the wage, preference, birth weight and substitution channels need to dominate the time productivity channel for cross-sectional parenting time choices. Note that given the partial derivative with respect to w is positive, if $\rho < 0$, but negative if $\rho > 0$, higher-wage parents will spend more time on activities that are complementary to market goods, and less on activities for which their time can be substitutable with market goods, all else equal.

3. How do Marshallian demands change after a decrease in the price of daycare?

For further derivation, note that $\frac{\partial \psi_K}{\partial(-m)} = \left(\frac{\rho_K}{\rho_K - 1}\right) \psi_K \frac{1}{2} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)$.

Child Market Goods: demand increases, irrespective of the sign of the substitution parameter:

$$\frac{\partial X_K^*}{\partial(-m)} = \frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \frac{1}{2} m^{-\frac{1}{2}} \left(\frac{w}{m} + \frac{1}{2}\right)}{\left(\frac{1}{Q}\right)^{\frac{1}{2}} (1+\psi_K)^2} \left(1 + \psi_K \left(\frac{1}{1 - \rho_K}\right)\right) > 0. \tag{40}$$

Time Spent with the Child: demand increases if $\rho_K < 0$:

$$\frac{\partial T_K^*}{\partial(-m)} = \frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \psi_K \frac{1}{2} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)}{(1+\psi_K)^2} \left(\frac{\rho_K}{\rho_K - 1}\right) > 0 \text{ if } \rho_K < 0. \tag{41}$$

Parents will spend more on X_K after daycare becomes cheaper, as their total potential household income increases and parenting time becomes more expensive, relative to X_K. Then, parents will spend more time with their children if $\rho_K < 0$, *i.e.*, if parenting time and market goods are complements in child skill formation.

4. How do child good responses after a fall in daycare price depend on schooling?

Now, I totally differentiate the expression in (40) with respect to S, and do the decomposition.

WAGE CHANNEL: the partial derivative with respect to w is:

$$\frac{\frac{\beta_K K_0}{\bar{C}}\bar{T}\frac{1}{2}m^{-\frac{1}{2}}}{\left(\frac{1}{Q}\right)^{\frac{1}{2}}(1+\psi_K)^3}\left\{\underbrace{\frac{\partial\psi_K}{\partial w}\left(\frac{\rho_K\left(\frac{1}{2}+\frac{w}{m}\right)}{1-\rho_K}\right)}_{[1]}+\underbrace{\left(1+\psi_K\left(\frac{1}{1-\rho_K}\right)\right)\frac{1}{m}\left(1+\psi_K\left(1-\left(\frac{\left(\frac{2w+m}{2w-m}\right)\rho_K}{\rho_K-1}\right)\right)\right)}_{[2]}\right\}.$$

First note that $\frac{\rho_K}{\rho_K-1}$ is positive if $\rho_K<0$, that is if time and market goods are complements in child human capital production, in which case also $\frac{\partial\psi_K}{\partial w}=\left(\frac{\rho_K}{\rho_k-1}\right)\frac{\psi_K}{\left(w-\frac{1}{2}m\right)}$ is positive, and term [1] is negative. Term [2] is ambiguous, making the sign of the expression ambiguous, as well.

TIME PRODUCTIVITY CHANNEL: the partial derivative with respect to γ_K is:

$$\frac{\frac{\beta_K K_0}{\bar{C}}\bar{T}\frac{1}{2}m^{-\frac{1}{2}}\left(\frac{1}{2}+\frac{w}{m}\right)}{\left(\frac{1}{Q}\right)^{\frac{1}{2}}(1+\psi_K)^3}\frac{\partial\psi_K}{\partial\gamma_K}\left(\frac{-1+2\rho_K}{1-\rho_K}\right).$$

First note that $\frac{\rho_K}{1-\rho_K}$ is negative if $\rho_K<0$, that is if time and market goods are complements in child human capital production, in which case also $\frac{\partial\psi_K}{\partial\gamma_K}=\left(\frac{\rho_K}{1-\rho_k}\right)\frac{\psi_K}{\gamma_K}$ is negative. Thus, the partial derivative is positive if $\rho_K<0$, suggesting that parents with higher time productivity will increase their demand for child market goods to a larger extent after a decrease in the price of daycare, all else equal.

SUBSTITUTABILITY CHANNEL: the partial derivative with respect to ρ_K is ambiguous:

$$\frac{\frac{\beta_K K_0}{\bar{C}}\bar{T}\frac{1}{2}m^{-\frac{1}{2}}\left(\frac{1}{2}+\frac{w}{m}\right)}{\left(\frac{1}{Q}\right)^{\frac{1}{2}}(1+\psi_K)^3}\left\{\left[\frac{\partial\psi_K}{\partial\rho_K}\left(\frac{1}{1-\rho_K}\right)+\psi_K\left(\frac{1}{(1-\rho_K)^2}\right)\right](1+\psi_K)-2\left(1+\psi_K\left(\frac{1}{1-\rho_K}\right)\right)\frac{\partial\psi_K}{\partial\rho_K}\right\}.$$

PREFERENCE CHANNEL: the partial derivative with respect to β_K is positive:

$$\frac{\frac{K_0}{\bar{C}}\bar{T}\frac{1}{2}m^{-\frac{1}{2}}\left(\frac{w}{m}+\frac{1}{2}\right)}{\left(\frac{1}{Q}\right)^{\frac{1}{2}}(1+\psi_K)^2}\left(1+\psi_K\left(\frac{1}{1-\rho_K}\right)\right)>0.$$

BIRTH WEIGHT CHANNEL: the partial derivative with respect to K_0 is positive:

$$\frac{\frac{\beta_K}{\bar{C}}\bar{T}\frac{1}{2}m^{-\frac{1}{2}}\left(\frac{w}{m}+\frac{1}{2}\right)}{\left(\frac{1}{Q}\right)^{\frac{1}{2}}(1+\psi_K)^2}\left(1+\psi_K\left(\frac{1}{1-\rho_K}\right)\right)>0.$$

Thus, high-educated parents will increase child market goods to a larger extent through the time productivity channel (if $\rho_K<0$), the preference and birth weight channels. If time and market goods are complements in child skill formation (and ρ_K is negative enough), high-educated parents increasing child market goods to a larger extent would indicate that the time productivity, preference and birth weight channels need to dominate the ambiguous wage and substitutability channels for responses in child market goods, after m falls.

5. How do parenting time responses after a fall in daycare price depend on schooling?

Now, I totally differentiate the expression in (41) with respect to S, and do the decomposition.

WAGE CHANNEL: the partial derivative with respect to w is:

$$\frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \frac{1}{2} \left(\frac{\rho_K}{\rho_K - 1}\right)}{(1+\psi_K)^3} \left\{ \underbrace{\frac{\partial \psi_K}{\partial w} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)(1-\psi_K)}_{[1]} + \underbrace{\psi_K (1+\psi_K) \frac{-1}{\left(w - \frac{1}{2}m\right)^2}}_{[2]} \right\}.$$

First note that $\frac{\rho_K}{\rho_K - 1}$ is positive if $\rho_K < 0$, in which case also $\frac{\partial \psi_K}{\partial w} = \left(\frac{\rho_K}{\rho_k - 1}\right) \frac{\psi_K}{\left(w - \frac{1}{2}m\right)}$ is positive. Furthermore, term [1] is negative if $\psi_K > 1$ (which is verified using the parameter estimates from 5.4)[59] and term [2] is unambiguously negative. Thus, the partial derivative is negative if $\rho_K < 0$, suggesting that higher-wage parents will increase their parenting time to a smaller extent after a decrease in the price of daycare, all else equal.

TIME PRODUCTIVITY CHANNEL: the partial derivative with respect to γ_K is:

$$\frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \frac{1}{2} \left(\frac{\rho_K}{\rho_K - 1}\right) \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)}{(1+\psi_K)^3} \frac{\partial \psi_K}{\partial \gamma_K} (1 - \psi_K).$$

First note that $\frac{\rho_K}{1-\rho_K}$ is negative if $\rho_K < 0$, in which case also $\frac{\partial \psi_K}{\partial \gamma_K} = \left(\frac{\rho_K}{1-\rho_k}\right) \frac{\psi_K}{\gamma_K}$ is negative. Furthermore, $1 - \psi_K$ is negative if $\psi_K > 1$ (which is verified using the parameter estimates from Section 5.4). Thus, the partial derivative is positive if $\rho_K < 0$, suggesting that parents with higher time productivity will increase their parenting time to a larger extent after a decrease in the price of daycare, all else equal.

SUBSTITUTABILITY CHANNEL: the partial derivative with respect to ρ_K is:

$$\frac{\frac{\beta_K K_0}{\bar{C}} \bar{T} \frac{1}{2} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)}{(1+\psi_K)^3} \cdot \frac{(-\psi_K)}{(\rho_K - 1)^2} \left\{ (1+\psi_K) + \left(\frac{\rho_K}{\rho_K - 1}\right)(1-\psi_K) \, log\left(\frac{w - \frac{1}{2}m}{\alpha \gamma_K}\right) \right\}.$$

Note that $\frac{\rho_K}{\rho_K - 1}$ is positive if $\rho_K < 0$, that is if time and market goods are complements in child skill formation. The sign of the expression in curly brackets is ambiguous, but if $\frac{w - \frac{1}{2}m}{\alpha \gamma_K}$ is large enough and ρ_K is negative enough, then $\left(\frac{\rho_K}{\rho_K - 1}\right)(1 - \psi_K) \, log\left(\frac{w - \frac{1}{2}m}{\alpha \gamma_K}\right)$ is larger in absolute value than $1 + \psi_K$,[60] and the partial derivative is ultimately positive, suggesting that parents with lower ρ will increase their parenting time to a smaller extent.

PREFERENCE CHANNEL: the partial derivative with respect to β_K is positive, provided that $\rho_K < 0$:

$$\frac{\frac{K_0}{\bar{C}} \bar{T} \psi_K \frac{1}{2} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)}{(1+\psi_K)^2} \left(\frac{\rho_K}{\rho_K - 1}\right) > 0.$$

BIRTH WEIGHT CHANNEL: the partial derivative with respect to K_0 is positive, provided that $\rho_K < 0$:

$$\frac{\frac{\beta_K}{\bar{C}} \bar{T} \psi_K \frac{1}{2} \left(\frac{\frac{1}{2} + \frac{w}{m}}{w - \frac{1}{2}m}\right)}{(1+\psi_K)^2} \left(\frac{\rho_K}{\rho_K - 1}\right) > 0.$$

Thus, high-educated parents will increase their parenting time to a larger extent through the PPT channel (if $\rho_K < 0$), the preference and birth weight channels (but, to a smaller extent through the substitutability and wage channels). If time and market goods are complements in child skill formation, high-educated parents increasing parenting time to a larger extent would indicate that the PPT, preference and birth weight channels need to dominate the wage and substitutability channels for responses in parenting time, after m falls.

[59] Using the structural parameter estimates, as well as parents' average characteristics in Québec pre-1997, I verify that ψ_K is 6.828 for high-educated and 6.425 for low-educated parents.

[60] Using the structural parameter estimates, as well as parents' average characteristics in Québec pre-1997, I verify that the expression in the curly bracket equals -2.971 for high-educated and -2.245 for low-educated.

H Appendix: Expressing Structural Parameters from Marshallian Demands and Identification of Structural Parameters

(A1) (To build intuition, I start with identification of ρ_K for all, and then extent this simpler case in **(A2)**.)

To express structural parameters ρ_K, δ, ξ (and γ_0), consider the ratio of Marshallian demands T_K^* and X_K^*:

$$\frac{T_K^*}{X_K^*} = \frac{\alpha\gamma_K}{\left(w^M - \frac{1}{2}m\right)\theta_K}\frac{\psi_K}{\gamma_K} = \left(\frac{\left(w^M - \frac{1}{2}m\right)\theta_K}{\alpha\gamma_K}\right)^{\frac{1}{\rho_K - 1}}\frac{1}{\gamma_K} = \left(\frac{\left(w^M - \frac{1}{2}m\right)\theta_K}{\alpha}\right)^{\frac{1}{\rho_K - 1}}\gamma_K^{\frac{\rho_K}{1-\rho_K}}. \tag{42}$$

Taking the logarithm of both sides of (42), using that in optimum, $\theta_K = \left(\frac{w^F - \frac{1}{2}m}{w^M - \frac{1}{2}m}\right)^{0.5}$ and $\alpha = \left(\frac{m}{Q}\right)^{0.5}$, and using the parametric assumption on γ_K ($\gamma_K = \gamma_0 S^\delta P^\xi \varepsilon_\gamma$), the log-ratio in (42) can be written as:

$$log\left(\frac{T_{Ki}^*}{X_{Ki}^*}\right) = \beta_{A0} + \beta_A logE_i + \beta_{AS} logS_i + \beta_{AP} logP_i + \epsilon_{Ai},, \tag{43}$$

where $\beta_{A0} = \left(\frac{\rho_K}{1-\rho_K}\right) log\gamma_0$, $\beta_A = \left(\frac{1}{\rho_K - 1}\right)$, $logE_i = log\left(w_i^M - \frac{1}{2}m_i\right) + \frac{1}{2}log\left(\frac{w_i^F - \frac{1}{2}m_i}{w_i^M - \frac{1}{2}m_i}\right) - \frac{1}{2}log\left(\frac{m_i}{Q_i}\right)$, $\beta_{AS} = \left(\frac{\rho_K}{1-\rho_K}\right)\delta$, $\beta_{AP} = \left(\frac{\rho_K}{1-\rho_K}\right)\xi$ and $\epsilon_A = \left(\frac{\rho_K}{1-\rho_K}\right) log\varepsilon_\gamma$.

(43) reveals that the log-ratio of Marshallian demands of T_K^* and X_K^* can be transformed into a regression in which the regression coefficients $(\beta_{A0}, \beta_A, \beta_{AS}, \beta_{AP})$ on observable variables $(logE, logS, logP)$ are non-linear functions of the structural parameters of interest $(\rho_K, \delta, \xi, \gamma_0)$, and the error term ϵ_A contains the logarithm of unobserved parenting ability and effort (ε_γ). In sum, the vector of structural parameters is:

$$\left(\ \rho_K,\quad \delta,\quad \xi,\quad \gamma_0\ \right) = \left(\ \frac{1+\beta_A}{\beta_A},\quad \beta_{AS}\left(\frac{1-\beta_A}{\beta_A}\right),\quad \beta_{AP}\left(\frac{1-\beta_A}{\beta_A}\right),\quad e^{\beta_{A0}\left(\frac{1-\beta_A}{\beta_A}\right)}\ \right).$$

Identification. The structural parameters can be expressed from the regression coefficients $(\beta_{A0}, \beta_A, \beta_{AS}, \beta_{AP})$, to the extent that those regression coefficient are identified in (43). /I assume for now that the regressors in (43) do not contain any predicted values, and return to this issue later./

The first ID requirement (**ID1**) is weak exogeneity of $logS$ and $logP$ in (43):

$$\textbf{ID1: (i) } E\left(logS_i \cdot \epsilon_{Ai}\right) = 0;\ \text{(ii) } E\left(logP_i \cdot \epsilon_{Ai}\right) = 0.$$

A concern regarding endogeneity remains even if **ID1** is met: in (43), the variable E is potentially endogenous, being a function of both parents' wages: it might happen that unobserved parenting ability and effort, though assumed to be unrelated to parental education S and parental mental health P, are related to parents' wage through some general ability (even conditional on S and P).

To overcome endogeneity, I use a binary variable policy_{tp} as an Instrumental Variable (IV), that takes the value of 1 if the household lives in Québec with the daycare policy in effect at time t, and 0 otherwise. The corresponding 1^{st}-stage equation for the endogenous $logE$ is the following:

$$logE_i = \tau_0 + \tau_1 \text{policy}_{tp} + \tau_2 logS_i + \tau_3 logP_i + \eta_{1i}. \tag{44}$$

To formally state the further ID requirements, I define X_{1i}, an endogenous regressor with a coefficient β_1, and X_{2i}, a 3-vector of weakly exogenous regressors (under **ID1)** with β_2, and re-write (43) into (46):

$$log\left(\frac{T_{Ki}^*}{X_{Ki}^*}\right) \equiv logY_i^A, X_{1i} \equiv logE_i,\ \beta_1 \equiv \beta_A,\ X_{2i} \equiv \begin{pmatrix} 1 \\ logS_i \\ logP_i \end{pmatrix},\ \beta_2 \equiv \begin{pmatrix} \beta_{A0} \\ \beta_{AS} \\ \beta_{AP} \end{pmatrix}, \tag{45}$$

$$logY_i^A = X_i'\beta + \epsilon_{Ai} = \beta_1 X_{1i} + X_{2i}'\beta_2 + \epsilon_{Ai}. \tag{46}$$

For $policy_{tp}$ to be a valid IV, is has to be exogenous and excluded from (46) (*i.e.*, it does not repeat nor it is a linear combination of X_{2i}), but, it has to be correlated with the X_{1i} (conditional on X_{2i}). The last two requirements can be expressed in the following ***rank condition***, meaning that $E(Z_i X_i')$ has full rank:

$$rank\left(E(Z_i X_i')\right) = 4, \text{ where } X_i \equiv \begin{pmatrix} X_{1i} \\ X_{2i} \end{pmatrix} \text{ and } Z_i \equiv \begin{pmatrix} \text{policy}_{tp} \\ X_{2i} \end{pmatrix}. \tag{47}$$

Next, I write the linear projection of X_i' onto Z_i' as $X_i^{*\prime} = Z_i'\tau$, where τ is a 4×4 matrix:

$$\tau = \begin{pmatrix} \tau_1 & 0 & 0 & 0 \\ \tau_0 & 1 & 0 & 0 \\ \tau_2 & 0 & 1 & 0 \\ \tau_3 & 0 & 0 & 1 \end{pmatrix},$$

and $X_i' = X_i^{*\prime} + \eta_{1i}$ where $E(Z_i'\eta_{1i}) = 0$ and so $E(X_i^*\eta_{1i} = 0)$. Then, $E(Z_i X_i') = E(Z_i X_i^{*\prime}) = E(Z_i Z_i')\tau$, and since $E(Z_i Z_i')$ is non-singular, $E(Z_i X_i')$ has rank 4 if and only if τ has rank 4 – for this to be the case, $\tau_1 \neq 0$.

Then, formally, the further identification requirements are:

$$\begin{aligned} \textbf{ID2 (IV strength):} \quad & \tau_1 \neq 0 \\ \textbf{ID3 (IV exogeneity):} \quad & E\left(\text{policy}_{tp} \cdot \epsilon_{Ai}\right) = 0. \end{aligned}$$

To arrive at the identification result, I multiply both sides of (46) with Z_i and take expectations on both sides:

$$E\left(Z_i log Y_i^A\right) = E\left(Z_i X_i'\right)\beta + E\left(Z_i \epsilon_{Ai}\right). \tag{48}$$

From (48), β can be uniquely expressed with the help of population moments involving only observable variables, to the extent that $E\left(Z_i \epsilon_{Ai}\right) = 0$ (true under **ID1** and **ID3**) and that $\left[E\left(Z_i X_i'\right)\right]^{-1}$ exists (true if the ***rank condition*** holds). Thus, under **ID1**, **ID2** and **ID3**, using Z_i as IV, the identification result for β is

$$\beta = \left[E\left(Z_i X_i'\right)\right]^{-1} E\left(Z_i log Y_i^A\right), \tag{49}$$

from which the sample analogue IV estimator, $\hat{\beta}_n$, follows:

$$\hat{\beta}_n = \left[\frac{1}{n}\sum_{i=1}^n Z_i X_i'\right]^{-1} \frac{1}{n}\sum_{i=1}^n Z_i log Y_i^A = \left[\sum_{i=1}^n Z_i X_i'\right]^{-1} \sum_{i=1}^n Z_i log Y_i^A = \left(Z'X\right)^{-1} Z' log Y^A. \tag{50}$$

Given the exactly identified case and the ***rank condition***, the IV estimator is equivalent to the 2SLS estimator:

$$\hat{\beta}_n = \left(\hat{X}'\hat{X}\right)^{-1} \hat{X}' log Y^A, \text{ where } \hat{X} = Z(Z'Z)^{-1}Z'X = P_Z X. \tag{51}$$

Consistency. For showing consistency of $\hat{\beta}_n$, I additionally assume that (i) $\{(Y_i, X_i, Z_i) : i \geq 1\}$ are IID, (ii) $E\left(X_{i,j}^2\right) < \infty$ for $j = 1, ..., 4$, (iii) $E\left(Z_{i,j}^2\right) < \infty$ for $j = 1, ..., 4$, and (iv) $E\left(\epsilon_{Ai} Z_i Z_i'\right)$ is positive definite.

$$\hat{\beta}_n = \beta + \left[\frac{1}{n}\sum_{i=1}^n Z_i X_i'\right]^{-1} \frac{1}{n}\sum_{i=1}^n Z_i \epsilon_{Ai}. \tag{52}$$

Under (ii) and (iii), by the *Cauchy-Schwartz inequality*, $E|Z_{i,r}X_{i,s}| \leq \sqrt{E\left(Z_{i,r}^2\right) E\left(X_{i,s}^2\right)} < \infty$ for all $r, s = 1, ..., 4$; therefore, by (i)–(iv), using *Slutsky's Theorem* and the *Weak Law of Large Numbers*,

$$\begin{aligned} \hat{\beta}_n \quad &\to_p \quad \beta + \left[E\left(Z_i X_i'\right)\right]^{-1} E\left(Z_i \epsilon_{Ai}\right) \\ &= \quad \beta. \end{aligned}$$

Asymptotic Normality. Finally, I show asymptotic normality of $\hat{\beta}_n$, for which I additionally assume that (v)

$E\left(Z_{i,j}^4\right) < \infty$ for $j = 1, ..., 4$ and (vi) $E(\epsilon_{Ai}^4) < \infty$. Consider $\sqrt{n}\left(\hat{\beta}_n - \beta\right) = \left[\frac{1}{n}\sum_{i=1}^{n} Z_i X_i'\right]^{-1} \frac{1}{\sqrt{n}}\sum_{i=1}^{n} Z_i \epsilon_{Ai}$. Under (v) and (vi), by the *Cauchy-Schwartz inequality*, $E|\epsilon_{Ai}^2 Z_{i,r} Z_{i,s}| \leq \left(E\left(\epsilon_{Ai}^4\right)\right)^{0.5} \left(E\left(Z_{i,r}^4\right) E\left(Z_{i,s}^4\right)\right)^{0.25} < \infty$ for all $r, s = 1, ..., 4$. Then, by the *Central Limit Theorem* and the *Cramer Convergence Theorem*,

$$\sqrt{n}\left(\hat{\beta}_n - \beta\right) \quad \rightarrow_d \quad \left[E\left(Z_i X_i'\right)\right]^{-1} N\left(0, E\left(\epsilon_{Ai} Z_i Z_i'\right)\right) \tag{53}$$

$$= \quad N\left(0, V\right), \tag{54}$$

where $V = \left[E\left(Z_i X_i'\right)\right]^{-1} E\left(\epsilon_{Ai} Z_i Z_i'\right) \left[E\left(X_i Z_i'\right)\right]^{-1}$ is the asymptotic variance-covariance matrix of $\hat{\beta}_n$.

(A2) To identify the substitution parameter between time and market goods in child skill formation, ρ_K, separately for low- and high-educated parents, I include an interaction variable between the endogenous $logE$ and an indicator variable 'high-educ' into (46), from which $\rho_K^L = \frac{1+\beta_{AL}}{\beta_{AL}}$ and $\rho_K^H = \frac{1+\beta_{AL}+\beta_{AH}}{\beta_{AL}+\beta_{AH}}$:

$$logY_i^A = \tilde{\beta}_{A0} + \tilde{\beta}_{AL} logE_i + \tilde{\beta}_{AH} logE_i \cdot \text{high-educ}_i + \tilde{\beta}_{AS} logS_i + \tilde{\beta}_{AP} logP_i + \epsilon_{Ai}, \tag{55}$$

with a corresponding 1^{st}-stage equation for the endogenous $logE$:

$$logE_i = \pi_0 + \pi_1 \text{policy}_{tp} + \pi_2 \text{policy}_{tp} \cdot \text{high-educ}_i + \pi_3 logS_i + \pi_4 logP_i + \eta_{2i}, \tag{56}$$

or, equivalently,

$$logY_i^A = \tilde{\beta}_{A0} + \tilde{\beta}_{AL} logE_i^L + (\tilde{\beta}_{AL} + \tilde{\beta}_{AH}) logE_i^H + \tilde{\beta}_{AS} logS_i + \tilde{\beta}_{AP} logP_i + \epsilon_{Ai}, \tag{57}$$

and

$$logE_i = \pi_0 + \pi_1 \text{policy}_{tp}^L + (\pi_1 + \pi_2) \text{policy}_{tp}^H + \pi_3 logS_i + \pi_4 logP_i + \eta_{2i}, \tag{58}$$

where $logE_i^L$ and policy_{tp}^L are $logE_i$ and policy_{tp} for low-educated families (and 0 otherwise), and similarly, $logE_i^H$ and policy_{tp}^H are $logE_i$ and policy_{tp} for high-educated families (and 0 otherwise).

Next, I write the linear projection of $\tilde{X}_i'$ onto $\tilde{Z}_i'$ as $\tilde{X}_i^{*\prime} = \tilde{Z}_i'\pi$, where π is a 5×5 matrix, and

$$\tilde{X}_i \equiv \begin{pmatrix} logE_i^L \\ logE_i^H \\ X_{2i} \end{pmatrix} \tilde{Z}_i \equiv \begin{pmatrix} \text{policy}_{tp}^L \\ \text{policy}_{tp}^H \\ X_{2i} \end{pmatrix}, \text{ and } \pi = \begin{pmatrix} \pi_1 & 0 & 0 & 0 & 0 \\ 0 & \pi_1 + \pi_2 & 0 & 0 & 0 \\ \pi_0 & \pi_0 & 1 & 0 & 0 \\ \pi_3 & \pi_3 & 0 & 1 & 0 \\ \pi_4 & \pi_4 & 0 & 0 & 1 \end{pmatrix},$$

and similarly as before, $\tilde{X}_i' = \tilde{X}_i^{*\prime} + \eta_{2i}$ where $E(\tilde{Z}_i'\eta_{2i}) = 0$ and so $E(\tilde{X}_i^* \eta_{2i} = 0)$.

Then, $E(\tilde{Z}_i \tilde{X}_i') = E(\tilde{Z}_i \tilde{X}_i^{*\prime}) = E(\tilde{Z}_i \tilde{Z}_i')\pi$, and since $E(\tilde{Z}_i \tilde{Z}_i')$ is non-singular, $E(\tilde{Z}_i \tilde{X}_i')$ has rank 5 if and only if π has rank 5 – for this to be the case, $\pi_1 \neq 0$ and $\pi_1 + \pi_2 \neq 0$.

Then, formally, the slightly modified identification requirement is:

ID2' (IV strength): $\pi_1 \neq 0$ and $\pi_1 + \pi_2 \neq 0$.

Let $\tilde{\beta} = (\tilde{\beta}_{A0}, \tilde{\beta}_{AL}, \tilde{\beta}_{AH}, \tilde{\beta}_{AS}, \tilde{\beta}_{AP})'$ be the coefficient vector in (55). Under **ID1**, **ID2'** and **ID3**, $\tilde{\beta}$ is identified.

For an alternative derivation of **ID2'**, let us re-write (55) into the following 2^{nd}-stage equation:

$$logY_i^A = \tilde{\beta}_{AL} logE_i + \tilde{\beta}_{AH} logE_i \cdot \text{high-educ}_i + X_{2i}'\tilde{\beta}_2 + \epsilon_{Ai}, \tag{59}$$

where $\tilde{\beta}_2 = (\tilde{\beta}_{A0}, \tilde{\beta}_{AS}, \tilde{\beta}_{AP})'$. Given from **ID1** it follows that X_{2i} is exogenous (*i.e.*, $E(X_{2i}\epsilon_{Ai}) = 0$), partialling X_2 out from (59) is helpful to simplify exposition for the ID requirements. Using the projection matrix $M_2 = I_n - X_2(X_2'X_2)^{-1}X_2'$ onto $\mathcal{S}^{\perp}(X_2)$, and let $log\check{V} \equiv M_2 logV$, the 2^{nd}-stage equation can be re-written as:

$$log\check{Y}_i^A = \tilde{\beta}_{AL} log\check{E}_i + \tilde{\beta}_{AH} log\check{E}_i \cdot \text{high-educ}_i + \check{\epsilon}_{Ai}, \tag{60}$$

where the corresponding 1^{st}-stage equation for the endogenous $log\check{E}$ is:

$$log\check{E}_i = \pi_1 \text{poli}\check{\text{cy}}_{tp} + \pi_2 \text{poli}\check{\text{cy}}_{tp} \cdot \text{high-educ}_i + \check{\eta}_{2i}. \tag{61}$$

In (61), poli$\check{\text{cy}}_{tp}$ and poli$\check{\text{cy}}_{tp} \cdot$ high-educ$_i$ are exogenous given **ID1** and **ID3**. Next, define IVs $\check{\zeta}_{1i} \equiv \pi_1 \text{poli}\check{\text{cy}}_{tp} + \pi_2 \text{poli}\check{\text{cy}}_{tp} \cdot \text{high-educ}_i$ and $\check{\zeta}_{2i} \equiv \check{\zeta}_{1i} \cdot \text{high-educ}_i$. Then, in (60), $\tilde{\beta}_{AL}$ and $\tilde{\beta}_{AH}$ are identified if and only if the ***rank condition*** is satisfied, so that the following matrix has rank 2:

$$E\begin{pmatrix} \check{\zeta}_{1i} \\ \check{\zeta}_{2i} \end{pmatrix}\begin{pmatrix} log\check{E}_i & log\check{E}_i \cdot \text{high-educ}_i \end{pmatrix} = E\begin{pmatrix} \check{\zeta}_{1i} \\ \check{\zeta}_{2i} \end{pmatrix}\begin{pmatrix} \check{\zeta}_{1i} + \check{\eta}_i & (\check{\zeta}_{1i} + \check{\eta}_{2i}) \cdot \text{high-educ}_i \end{pmatrix}. \tag{62}$$

The rank of the matrix in (62) can be determined based on its determinant:

$$det\begin{pmatrix} E(\check{\zeta}_{1i}^2) & E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) \\ E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) & E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) \end{pmatrix} = E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) \cdot \left(E(\check{\zeta}_{1i}^2) - E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i)\right) \tag{63}$$

The matrix in (62) is singular if (i) $E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i)$ or (ii) $E(\check{\zeta}_{1i}^2) - E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i)$ is 0, which are:
(i) $E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) = (\pi_1 + \pi_2)^2 E\left(\text{policy}_{tp}^2 \text{high-educ}_i\right)$;
(ii) $E(\check{\zeta}_{1i}^2) - E(\check{\zeta}_{1i}^2 \cdot \text{high-educ}_i) = \pi_1^2 E\left(\text{policy}_{tp}^2 (1 - \text{high-educ}_i)\right)$.

Thus, the rank of the matrix in (62) is 2 unless $\pi_1 + \pi_2 = 0$ or $\pi_1 = 0$; *i.e.*, it is required that policy$_{tp}$ and $logE$ are related for both high- and low-educated parents in the 1^{st}-stage equations (56) and (61).

Thus, under **ID1**, **ID2'** and **ID3**, $\tilde{\beta}$ is identified in (59), and the IV/2SLS estimator is:

$$\hat{\tilde{\beta}}_n = \left[\sum_{i=1}^n \hat{\tilde{X}}_i \tilde{X}_i'\right]^{-1} \sum_{i=1}^n \hat{\tilde{X}}_i logY_i^A, \tag{64}$$

where $\tilde{X}_i \equiv \begin{pmatrix} logE_i \\ logE_i \cdot \text{high-educ}_i \\ X_{2i} \end{pmatrix}$, $\hat{\tilde{X}}_i \equiv \begin{pmatrix} P_{\tilde{Z}_i} logE_i \\ (P_{\tilde{Z}_i} logE_i) \cdot \text{high-educ}_i \\ X_{2i} \end{pmatrix}$, and $\tilde{Z}_i \equiv \begin{pmatrix} \text{policy}_{tp} \\ \text{policy}_{tp} \cdot \text{high-educ}_i \\ X_{2i} \end{pmatrix}$.
Note that $P_{\tilde{Z}} logE$ are predicted values of $logE$ from the 1^{st}-stage equation (56), which are then used to form the IVs. Using previous arguments, $\hat{\tilde{\beta}}_n$ is consistent and asymptotically normal: $\sqrt{n}(\hat{\tilde{\beta}}_n - \tilde{\beta}) \to_d \tilde{Y} \sim N(0, \tilde{V})$.

(B) To express φ and ς, consider $X_K^* = \frac{\frac{1}{2}\beta_K K_0 I}{C\alpha(1+\psi_K)}$, that, using the optimality condition for T_K^* as well, can be transformed into $\frac{X_K^*\alpha + T_K^{M*}\left(w^M - \frac{1}{2}m\right)}{I} = \frac{\beta_K K_0}{2C}$, where $Y^B \equiv \frac{X_K^*\alpha + T_K^{M*}\left(w^M - \frac{1}{2}m\right)}{I}$ is the share of child expenditures on market goods and maternal child time, relative to potential household income. Then, using the parametric

assumptions on β_K and K_0 ($\beta_K = \beta_0 S^{\varphi}\varepsilon_\beta$ and $K_0 = W^{\varsigma}$), one arrives at the following regression:

$$logY_i^B = \bar{\beta_0} + \varphi logS_i + \varsigma logW_i + \epsilon_{Bi}, \tag{65}$$

where W is child birth weight, and the error term ϵ_B contains the logarithm of the unobserved heterogeneity in preferences for child human capital (ε_β). The last ID requirement (**ID4**) is weak exogeneity of $logS$ and $logW$:

ID4: (i) $E\left(logS_i \cdot \epsilon_{Bi}\right) = 0$ and (ii) $E\left(logW_i \cdot \epsilon_{Bi}\right) = 0$.

I Appendix: Derivation of Standard Errors of Structural Parameters

As shown previously, $\sqrt{n}(\hat{\tilde{\beta}}_n - \tilde{\beta}) \to_d \tilde{Y} \sim N(0, \tilde{V})$, where $\tilde{\beta}$ is the following 5×1 matrix:

$$\tilde{\beta} = \begin{pmatrix} \tilde{\beta}_{AL} \\ \tilde{\beta}_{AH} \\ \tilde{\beta}_{AS} \\ \tilde{\beta}_{AP} \\ \tilde{\beta}_{A0} \end{pmatrix}.$$

The vector of structural parameters is the following:

$$h(\tilde{\beta}) = \begin{pmatrix} \rho_K^L \\ \rho_K^H \\ \delta \\ \xi \\ \gamma_0 \end{pmatrix} = \begin{pmatrix} \frac{1}{\tilde{\beta}_{AL}} + 1 \\ \frac{1}{\tilde{\beta}_{AL} + \tilde{\beta}_{AH}} + 1 \\ \tilde{\beta}_{AS}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right) \\ \tilde{\beta}_{AP}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right) \\ e^{\tilde{\beta}_{A0}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right)} \end{pmatrix}, \text{ where } \bar{\tilde{\beta}}_A = \frac{\frac{2}{3}}{\tilde{\beta}_{AL} + \tilde{\beta}_{AH}} + \frac{\frac{1}{3}}{\tilde{\beta}_{AL}} + 1.$$

By the Delta Method, $\sqrt{n}(h\left(\hat{\tilde{\beta}}_n\right) - h\left(\tilde{\beta}\right)) \to_d \frac{\partial h(\tilde{\beta})}{\partial \tilde{\beta}'}\tilde{Y}$ as $n \to \infty$, where $\frac{\partial h(\tilde{\beta})}{\partial \tilde{\beta}'}$ is the following 5×5 matrix:

$$\frac{\partial h(\tilde{\beta})}{\partial \tilde{\beta}'} = \begin{pmatrix} -\left(\tilde{\beta}_{AL}\right)^{-2} & 0 & 0 & 0 & 0 \\ -\left(\tilde{\beta}_{AL} + \tilde{\beta}_{AH}\right)^{-2} & -\left(\tilde{\beta}_{AL} + \tilde{\beta}_{AH}\right)^{-2} & 0 & 0 & 0 \\ \tilde{\beta}_{AS}\tilde{\tilde{\beta}}_A^L & \tilde{\beta}_{AS}\tilde{\tilde{\beta}}_A^H & \tilde{\tilde{\beta}}_A & 0 & 0 \\ \tilde{\beta}_{AP}\tilde{\tilde{\beta}}_A^L & \tilde{\beta}_{AP}\tilde{\tilde{\beta}}_A^H & 0 & \tilde{\tilde{\beta}}_A & 0 \\ D51 & D52 & 0 & 0 & D_{55} \end{pmatrix},$$

where $\tilde{\tilde{\beta}}_A \equiv \frac{-\tilde{\beta}_{AL} - \frac{1}{3}\tilde{\beta}_{AH}}{Z}$, $\tilde{\tilde{\beta}}_A^L \equiv \frac{-Z - (-\tilde{\beta}_{AL} - \frac{1}{3}\tilde{\beta}_{AH})(2\tilde{\beta}_{AL} + \tilde{\beta}_{AH} + 1)}{Z^2}$, $\tilde{\tilde{\beta}}_A^H \equiv \frac{-\frac{1}{3}Z - (-\tilde{\beta}_{AL} - \frac{1}{3}\tilde{\beta}_{AH})(\tilde{\beta}_{AL} + \frac{1}{3})}{Z^2}$, $Z \equiv \tilde{\beta}_{AL}^2 + \tilde{\beta}_{AL}\tilde{\beta}_{AH} + \frac{1}{3}\tilde{\beta}_{AH} + \tilde{\beta}_{AL}$, $D_{51} \equiv e^{\tilde{\beta}_{A0}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right)}\tilde{\beta}_{A0}\tilde{\tilde{\beta}}_A^L$, $D_{52} \equiv e^{\tilde{\beta}_{A0}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right)}\tilde{\beta}_{A0}\tilde{\tilde{\beta}}_A^H$, $D_{55} \equiv e^{\tilde{\beta}_{A0}\left(\frac{1-\bar{\tilde{\beta}}_A}{\bar{\tilde{\beta}}_A}\right)}\tilde{\tilde{\beta}}_A$.

In ***Appendix F*** and ***Appendix H*** so far I have assumed that the regressors in (59) do not contain predicted values; now I describe how I approach the issue that they do. First, to get an estimate for $\tilde{V}$ from above, I bootstrap with 800 iterations to get $\hat{\tilde{V}}_{BS}$, and then form $\frac{\partial h(\hat{\tilde{\beta}})}{\partial \tilde{\beta}'}\hat{\tilde{V}}_{BS}\frac{\partial h(\hat{\tilde{\beta}})}{\partial \tilde{\beta}}$; the square roots of the diagonal terms

of $\frac{\partial h(\hat{\tilde{\beta}})}{\partial \tilde{\beta}'}\hat{\tilde{V}}_{BS}\frac{\partial h(\hat{\tilde{\beta}})}{\partial \tilde{\beta}}$ are the estimates for the standard errors corresponding to structural parameters in $h(\tilde{\beta})$.[61]

J Appendix: Structural Decomposition and Counterfactual Estimates

IA) The Procedure for the Structural Decomposition

This section describes how the estimated structural parameters in Section 5.4 are used to predict parenting time, and to quantify the extent to which the various channels account for differences between high- and low-educated parents' time spent with their children before and after daycare becomes cheaper. I follow the steps below.

STEP 1. I collect average characteristics of parents in two-parent households in Québec, with at least one child below the age of 5, before 1997. These can be seen in Table J1, in *Panel A*.

Table J1: **Predicted Daycare and Parenting Time Use Using the Implied Structural Parameters and Average Characteristics of Parents, in Québec Before 1997 (Using P1 and Q1 Daycare Price and Quality Measures for Estimation of Structural Parameters)**

parental education:	**high**	**low**			**high**	**low**
Panel A: Input Values for Quebec, Before 1997				*Panel C: (Implied) Intermediate Values*		
years of schooling	15.0193	11.2575	CENSUS	$\frac{m}{Q}$	2.28305	1.78919
depression score	98.1292	98.6824	NLSCY	$w^M - \frac{1}{2}m$	14.67928	10.32808
birth weight (kg)	3.4424	3.1380	NLSCY	θ_K	1.09564	1.11408
mother's wage	15.6725	11.0908	LFS	α	1.51098	1.33761
father's wage	18.6147	13.5816	LFS	γ	0.87791	0.69218
father's working hours	37.7730	32.3055	LFS	ε_γ	*0.0042*	*0.0042*
predicted m (P1)	1.9864	1.5255	NLSCY	ψ_K	6.8291	6.4249
percent subsidy (P2)	2.1682	1.9376	CTACS	$\beta_K K_0$	0.0802	0.0619
parental expectations (Q1)	0.8701	0.8526	NLSCY	ε_β	*0.01*	*0.01*
class size (Q2)	8.6845	10.5210	NLSCY	I	3131	2149
Panel B: Estimated (Implied) Structural Parameters				*Panel D: Predicted Child Goods (Pre)*		
implied ρ	-2.55973	-2.96087		predicted X_K^*	21.2302	13.4094
implied δ	0.78740			predicted D^*	14.0506	10.0249
implied ξ	-0.50953			predicted $\triangle$	40.156%	
implied γ_0	237.7408			actual D^*	14.016	10.001
implied φ	0.59513			actual $\triangle$	40.15%	
implied ς	1.10894			*Panel E: Predicted Time Use (Pre)*		
implied β_0	-1.09203			predicted T_K^*	13.6206	10.0155
				predicted T_K^{M*}	14.9233	11.1581
				predicted T_K^{F*}	12.4317	8.99004

STEP 2. Using information from A and B, *Panel C* shows the intermediate inputs that form the Marshallian demands X_K^* and T_K^*. In this calculation, I use the fixed level of time productivity error ($\varepsilon_\gamma = 0.0042$), identical for high- and low-educated families that predicts the gap $\triangle$ in daycare choices (40.16%) observed in the data. Also, I use the fixed level of heterogeneity in preference for K ($\varepsilon_\beta = 0.012$) such that the predicted daycare choices closest match the actual daycare choices (around 14 (10) hours per week, on average, for high-educated (low-educated) parents, before 1997).

STEP 3. To predict post-1997 daycare and parenting time use choices, I determine the required decrease in $\frac{m}{Q}$ so that the predicted increase in daycare use matches the increase observed in the data (48.38 percent and 35.59 percent for high- and low-educated parents, respectively, from Table D1); this required decrease in $\frac{m}{Q}$ is -43.77 percent and -35.05 percent, respectively. Then, the predicted post-1997 daycare use is $\hat{D}^H_{post} = 20.879$ and $\hat{D}^L_{post} = 13.609$ for high- and low-educated parents, respectively, and their predicted parenting time use (at the household-level) is $\hat{T}^H_{Kpost} = 14.016$ and $\hat{T}^L_{Kpost} = 10.248$, respectively.

STEP 4. I verify that the predicted increase in T_K ($\frac{\hat{T}_{Kpost}}{\hat{T}_{Kpre}} - 1$) matches well the actual increase in parenting time (as observed in Table 3): the predicted increase is 2.65 and 2.07 percent for high- and low-educated mothers,

[61] The derivations follow closely the ECON527 Lecture 7 and 10 econometrics notes of Vadim Marmer (VSE UBC).

while it is 3.15 and 2.57 percent for high- and low-educated fathers, respectively. Thus, the implied parameters, together with pre-policy average characteristics of Québecoise families, is able to replicate the main reduced-form patterns observed in Tables D5 and D6, namely that both high- and low-educated parents increase parenting time, and fathers as well as high-educated increase it more than mothers and low-educated.

STEP 5. I decompose the absolute difference in $\hat{T}_{Kpre}$:

$$\triangle_1 = \hat{T}^H_{Kpre} - \hat{T}^L_{Kpre}, \tag{66}$$

into the various channels, by shutting down each channel one-by-one, until $\triangle_1 = 0$.

STEP 6. I decompose the absolute difference in $\uparrow \hat{T}_K$:

$$\triangle_2 = \uparrow \hat{T}^H_K - \uparrow \hat{T}^L_K = \left(\hat{T}^H_{Kpost} - \hat{T}^H_{Kpre}\right) - \left(\hat{T}^L_{Kpost} - \hat{T}^L_{Kpre}\right), \tag{67}$$

into the various channels, by shutting down each channel one-by-one, until $\triangle_2 = 0$.

IB) The Procedure of the Predicting the Level of Child Human Capital K, Assuming that the Productivity of Parenting Time $\hat{\gamma}_K$ Stays Constant

After the predicted daycare use and predicted parenting time is determined with steps 1–4 from above, both for the pre- and post-policy period, the predicted level of child human capital, $\hat{K}$, follows directly, by substituting in parameter estimates and average values from Table (J1) into $\hat{K}_t = \left(\left[(\hat{\gamma}_K \hat{T}_{Kt})^{\hat{\rho}_K} + \hat{X}^{\hat{\rho}_K}_{Kt}\right]^{\frac{1}{\hat{\rho}_K}}\right)^{\hat{K}_0}$, where t corresponds to either the pre- or the post-policy period, whereas the values $\hat{\gamma}_K$, $\hat{\rho}_K$ and $\hat{K}_0$ are kept fixed.

- **Predicted increase in the level of K, due to cheaper daycare:** For high-educated parents the predicted level of child human capital increases by 16.04 percent ($\frac{\hat{K}^H_{post}}{\hat{K}^H_{pre}} - 1$) from the pre- to the post-policy period, and for low-educated it increases by 11.78 percent ($\frac{\hat{K}^L_{post}}{\hat{K}^L_{pre}} - 1$).[62]
  - Decomposition of the predicted increase in the level of K, due to cheaper daycare into, the direct effect due to daycare use increase, and indirect effect due to parenting time increase:
    - Total Effect: $TE = \left(\left[(\hat{\gamma}_K \hat{T}_{Kpost})^{\hat{\rho}_K} + \hat{X}^{\hat{\rho}_K}_{Kpost}\right]^{\frac{1}{\hat{\rho}_K}}\right)^{\hat{K}_0} - \left(\left[(\hat{\gamma}_K \hat{T}_{Kpre})^{\hat{\rho}_K} + \hat{X}^{\hat{\rho}_K}_{Kpre}\right]^{\frac{1}{\hat{\rho}_K}}\right)^{\hat{K}_0}$.
    - Direct Effect: $DE = \left(\left[(\hat{\gamma}_K \hat{T}_{Kpre})^{\hat{\rho}_K} + \hat{X}^{\hat{\rho}_K}_{Kpost}\right]^{\frac{1}{\hat{\rho}_K}}\right)^{\hat{K}_0} - \left(\left[(\hat{\gamma}_K \hat{T}_{Kpre})^{\hat{\rho}_K} + \hat{X}^{\hat{\rho}_K}_{Kpre}\right]^{\frac{1}{\hat{\rho}_K}}\right)^{\hat{K}_0}$ — as if there was no increase in parenting time and no change in γ_K either.
      - Share of Direct Effect due to daycare use increase: $\frac{DE}{TE}$. For high-educated, $\frac{\hat{DE}}{\hat{TE}}$ is 30.2617 percent and for low-educated it is 33.7717 percent.[63]
      - Share of Indirect Effect due to parenting time increase: $1 - \frac{DE}{TE}$.
- ***Counterfactual*: Predicted change in the early childhood skill gap ($\frac{\hat{K}^H}{\hat{K}^L}$), under a targeted policy:** If high-educated are excluded from the policy that only targets low-educated, high-educated parents' predicted level of child human capital stays at $\hat{K}^H_{pre}$, while low-educated parents' increases to $\hat{K}^L_{post}$; as a result, the gap decreases by 10.5 percentage points.[64]

[62] If using P2 and Q2 for estimating the structural parameters, as a robustness check, the corresponding increases are 19.07 percent and 14.28 percent, respectively.

[63] If using P2 and Q2 for estimating the structural parameters, as a robustness check, the corresponding shares are 27.4892 percent and 30.8554 percent, respectively.

[64] If using P2 and Q2 for estimating the structural parameters, as a robustness check, the gap decreases by 12.5 percentage points.

IC) The Procedure of the Predicting the Level of Child Human Capital K, Assuming that the Productivity of Parenting Time $\hat{\gamma}_K$ Decreases

Using the values of $\varepsilon_\gamma = 0.0042$, $\varepsilon_\beta = 0.012$, and the decrease in $\frac{m}{Q}$ 43.77 percent and 35.05 percent for high-educated and low-educated, respectively, determined in steps 1–3 above, keeping all estimated structural parameters fixed, and allowing parents' depression score to increase by 10 percent as found by Baker et al. (2008), the optimal D^* in the post-period are 20.21 and 13.62 hours for high- and low-educated, respectively, and the optimal T_K^* in the post-period are 14.07 and 10.62 for high- and low-educated, respectively, leading to a 2.27 and 4.07 percent lower level of $\hat{K}_{post}$ for high- and low-educated, respectively, than $\hat{K}_{pre}$ in **IB)** above.

II) Prediction of Variables for Estimation of Structural Parameters

1. **Price of Daycare P1: (Deflated) Hourly Daycare Cost**
   (a) Data: NLSCY, waves 7 and 8; weekly daycare expenses over weekly hours in daycare, deflated.
   (b) The following variables are used for prediction, separately for Québec (in and not in CPE) and the rest-of-Canada: mother's education (low/middle/high), father's education (low/middle/high), province, the age of the youngest child, the mother's age (level and squared), the father's age (level and squared), household size. For Québec 1996, the predicted values for those not in CPE is considered, and for Québec in 2001, the predicted values for those in CPE is considered.
2. **Price of Daycare P2: Simulated Daycare Subsidy for (Deflated) Hourly Daycare Cost**
   (a) Software: **Canadian Tax and Credit Simulator** developed by Kevin Milligan at the Vancouver School of Economics (Milligan, 2016); *see* details in ***Appendix 10/III***.
3. **Quality of Daycare Q1: Share of Aspects in Which Daycare Meets Parents' Expectations and Q2: Number of Other Kids in Daycare Group (Class Size)**
   (a) Data: NLSCY, waves 7 and 8 for Q1 and waves 3 and 4 for Q2; considered aspects of daycare: caregiver characteristics, training of caregiver, safety of environment, stimulating environment, caregivers speak in language of choice, caregivers address special needs.
   (b) The following variables are used for prediction, separately for Québec (in and not in CPE) and the rest-of-Canada: mother's education (low/middle/high), father's education (low/middle/high), province, the age of the youngest child, the mother's age (level and squared), the father's age (level and squared), household size. For Québec in 1996, the predicted values for those not in CPE is considered, and for Québec in 2001, the predicted values for those in CPE is considered.
4. **birth weight (in Kilograms) and Parental Depression Score (Mean 100, St. Deviation 30)**
   (a) Data: NLSCY, waves 2, 4.
   (b) The following variables are used for prediction, separately for Québec and the rest-of-Canada, for 1996 and 2001: mother's education (low/middle/high), father's education (low/middle/high), province, the age of the youngest child, the mother's age (level and squared), the father's age (level and squared), household size.
5. **Hourly Wage of the Mother and the Father, and Working Hours of the Father**
   (a) Data: LFS, 1996, 2001; deflated to 2002 level.

(b) The following variables are used for prediction, separately for Québec and the rest-of-Canada, for 1996 and 2001: mother's education (low/middle/high), father's education (low/middle/high), province, the age of the youngest child, the mother's age (level and squared), the father's age (level and squared), household size.

6. **Household Expenditures on Child Market Goods**

(a) Data: SHS, 1996, 2004; deflated to 2002 level; included categories: child books, toys and games and child wear.

(b) The following variables are used for prediction, separately for Québec and the rest-of-Canada, for 1996 and 2001: mother's education (low/middle/high), father's education (low/middle/high), province, the age of the youngest child, the mother's age (level and squared), the father's age (level and squared), household size.

Tables J2 and J3 below show the predictive power of the models for each variable, and how well the predicted average of a given variable in the prediction sample matches the actual average in the estimation sample.

Table J2: **Actual and Predicted Average Daycare Hourly Price and Quality Measures**

Hourly Daycare Cost from NLSCY (P1)							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*NLSCY 7,8*	3.3203	1.3687	*high-educated*	*PRE (1996)*	3.30201	1.98637
					POST (2001)	3.33511	1.10164
low-educated	*NLSCY 7,8*	3.6160	1.2914	*low-educated*	*PRE (1996)*	4.03182	1.52554
not in CPE	*NLSCY 7,8*		1.8312		*POST (2001)*	3.99124	0.84004
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.1193	0.7997
					POST (2001)	0.1193	0.2753
Hourly Daycare Cost, Using Percent Subsidy from CTACS (P2)							
				predicted means		Rest-of-Canada	Québec
				high-educated	*PRE (1996)*	2.80363	2.16823
					POST (2001)	3.04065	0.52093
				low-educated	*PRE (1996)*	2.91966	1.93761
					POST (2001)	3.10315	0.52432
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	N/A	N/A
					POST (2001)	N/A	N/A
Share of Daycare Expectations Met (Q1)							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*NLSCY 7,8*	0.9022	0.8972	*high-educated*	*PRE (1996)*	0.91627	0.87005
					POST (2001)	0.89161	0.85695
low-educated	*NLSCY 7,8*	0.8894	0.9146	*low-educated*	*PRE (1996)*	0.90368	0.85264
not in CPE	*NLSCY 7,8*		0.8565		*POST (2001)*	0.87916	0.86051
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.0080	0.0822
					POST (2001)	0.0080	0.0020
Size of Daycare Class (Q2)							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*NLSCY 3*	22.443	10.242	*high-educated*	*PRE (1996)*	21.514	8.685
	NLSCY 4	17.049	9.400		*POST (2001)*	15.778	8.570
low-educated	*NLSCY 3*	29.132	12.485	*low-educated*	*PRE (1996)*	25.865	10.521
	NLSCY 4	19.426	10.846		*POST (2001)*	17.715	9.621
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.1250	0.1290
					POST (2001)	0.1084	0.0556

Note: this table shows, for each variable, the actual weighted mean in the source dataset, as well as the predicted weighted mean in the 1996 and 2001 Census sample, together with the R^2 of the prediction model.

Table J3: **Actual and Predicted Average Parental Wage, Household Expenditures, Child birth weight and Parental Depression Scores**

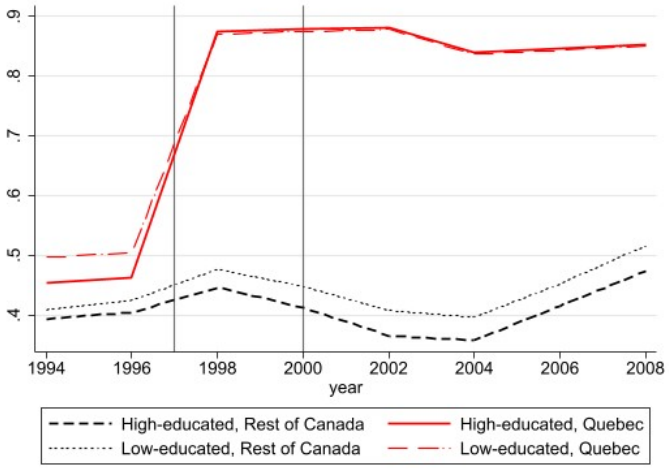
Mother's Hourly Wage							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*LFS 1996*	16.657	15.288	*high-educated*	*PRE (1996)*	16.988	15.672
	LFS 2001	18.064	17.558		*POST (2001)*	18.006	16.744
low-educated	*LFS 1996*	11.369	11.561	*low-educated*	*PRE (1996)*	11.177	11.090
	LFS 2001	12.978	10.920		*POST (2001)*	12.443	10.283
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.3375	0.2974
					POST (2001)	0.2743	0.4067
Father's Hourly Wage							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*LFS 1996*	18.923	17.979	*high-educated*	*PRE (1996)*	19.504	18.614
	LFS 2001	21.521	20.317		*POST (2001)*	21.667	19.723
low-educated	*LFS 1996*	15.972	14.115	*low-educated*	*PRE (1996)*	16.103	13.581
	LFS 2001	17.959	15.409		*POST (2001)*	17.499	14.503
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.2596	0.2304
					POST (2001)	0.2321	0.3338
Fraction of Child Expenditures							
actual means		Rest-of-Canada	Québec	**predicted mean models**		Rest-of-Canada	Québec
high-educated	*SHS 1996*	0.0297	0.04163	*high-educated*	*PRE (1996)*	0.0312	0.0418
	SHS 2004	0.03584	0.03870		*POST (2001)*	0.0353	0.0387
low-educated	*SHS 1996*	0.02679	0.02748	*low-educated*	*PRE (1996)*	0.0272	0.0265
	SHS 2004	0.02963	0.03775		*POST (2001)*	0.0297	0.0353
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.0290	0.0749
					POST (2001)	0.0450	0.0442
Fraction of Home Production Expenditures							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*SHS 1996*	0.03213	0.03301	*high-educated*	*PRE (1996)*	0.0326	0.0334
	SHS 2004	0.02166	0.02247		*POST (2001)*	0.0215	0.0211
low-educated	*SHS 1996*	0.03108	0.0310	*low-educated*	*PRE (1996)*	0.0317	0.0295
	SHS 2004	0.01663	0.02493		*POST (2001)*	0.0163	0.0246
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.0440	0.0430
					POST (2001)	0.0524	0.0747
birth weight							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*NLSCY 2*	3.4508	3.4049	*high-educated*	*PRE (1996)*	3.5120	3.4424
	NLSCY 4	3.4603	3.4086		*POST (2001)*	3.4425	3.3179
low-educated	*NLSCY 2*	3.3450	3.2230	*low-educated*	*PRE (1996)*	3.4103	3.1380
	NLSCY 4	3.3967	3.3349		*POST (2001)*	3.3754	3.1839
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.0220	0.0289
					POST (2001)	0.0121	0.0673
Parental Depression Score							
actual means		Rest-of-Canada	Québec	**predicted means**		Rest-of-Canada	Québec
high-educated	*NLSCY 2*	99.740	98.129	*high-educated*	*PRE (1996)*	94.786	84.728
	NLSCY 4	-	-		*POST (2001)*	-	-
low-educated	*NLSCY 2*	103.367	98.682	*low-educated*	*PRE (1996)*	119.369	86.525
	NLSCY 4	-	-		*POST (2001)*	-	-
				R^2 **of prediction models**		Rest-of-Canada	Québec
				all	*PRE (1996)*	0.0231	0.0303
					POST (2001)	-	-

Note: this table shows, for each variable, the actual weighted mean in the source dataset, as well as the predicted weighted mean in the 1996 and 2001 Census sample, together with the R^2 of the prediction model.

III) Simulation of the Percent Subsidy of Daycare Expenditures (for P2)

To generate the average simulated percent subsidy depicted in Figure (J1), I follow closely the steps in Appendix B of Baker et al. (2005), except that I use the NLSCY as the base file for the simulations; I select all two-parent families with at least one child below the age of 5. I assign each family a set level of daycare expenditures ($5,724 in 1998 dollars, the same across all provinces and years). For each family, I assign the direct childcare subsidy that accounts for the Québec daycare subsidy from 1997 on, as well as provincial low-income subsidies, where the remaining out-of-pocket daycare costs are used in the income tax calculation. For each family, I simulate their income tax with and without daycare expenses, and the difference yields the tax subsidy. The percent subsidy (ps) is calculated as the share of the sum of the direct subsidy and tax subsidy, out of all daycare expenses, and the effective hourly daycare price (P2) is then $(1 - ps) \cdot 4$.

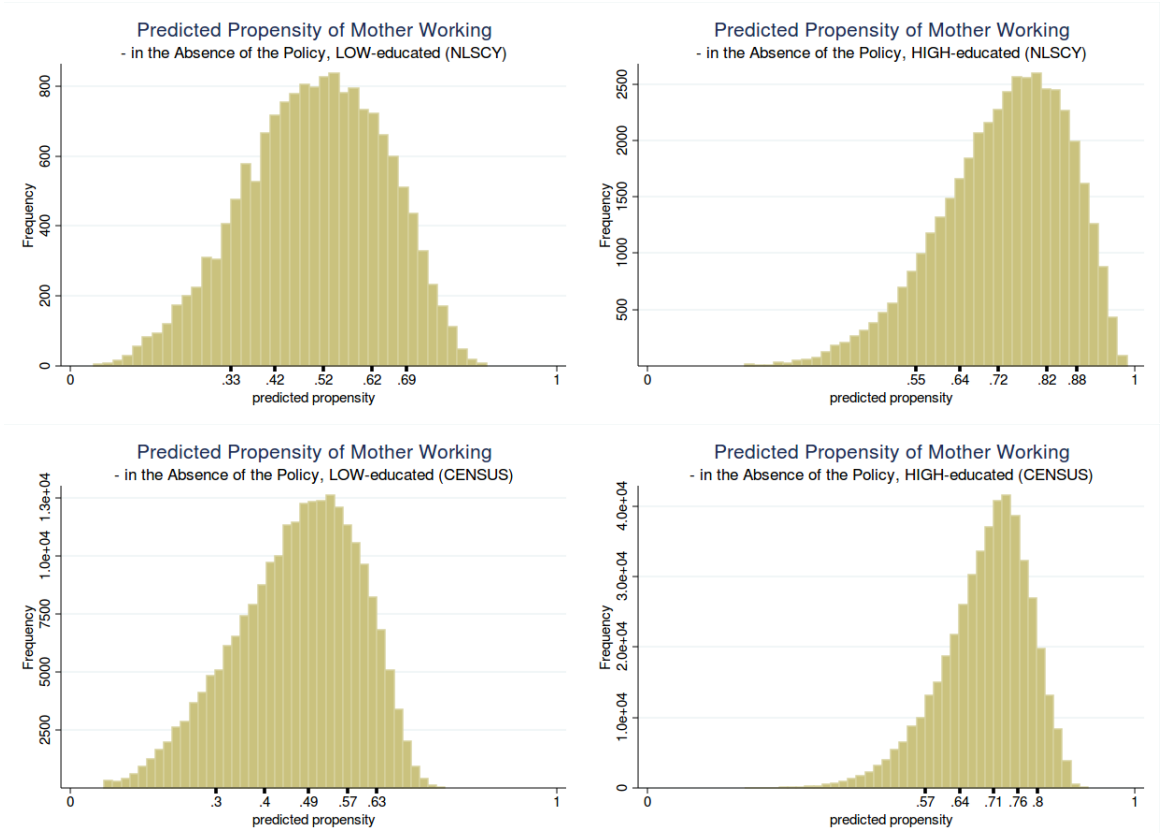
Figure J1: **Average Simulated Percent Subsidy, in Québec and the Rest-of-Canada, 1994-2008**



Note: these figures show the average simulated percent subsidy across families, using the Canadian Tax and Credit Simulator developed by Kevin Milligan (Milligan (2016)), and described above.

K Appendix: Details on the Propensity Score Estimation and Robustness Checks to Main Results

Figure K1: **Predicted Propensity of the Mother to Work in the Absence of the Policy**



Note: these histograms show the predicted propensity of the mother to work, predicted by the interaction of parental education of the mother and the father, a full set of year/province/age fixed effects, mother's and father's age and household size (the model was estimated on the pre-policy sample and predicted for the whole sample). Data: NLSCY waves 1-7 (1994-2006), 0-4 years old children in two-parent families, both parents at most 50 years old. The ticks on the x-axis in each graph correspond to the 10th, 25th, 50th, 75th and 90th percentile of the predicted propensity distribution.

Table K1: **Details on the Propensity Score Estimation, for High- and Low-Educated Families**

1: mother working	(1)	(2)	(3)	(4)	(5)	(6)
data & parental education:	*NLSCY high*	*NLSCY low*	*GSS high*	*GSS low*	*CENSUS high*	*CENSUS low*
mother: low – father: middle		0.1508***		1.5955***		0.0689***
		(0.049)		(0.418)		(0.010)
mother: low – father: high		0.0609		1.8545***		0.0254
		(0.103)		(0.479)		(0.023)
mother: middle – father: middle	0.0451		-0.8359		0.0011	
	(0.039)		(0.864)		(0.010)	
mother: middle – father: high	-0.1321**		-1.1139		-0.1194***	
	(0.058)		(0.844)		(0.014)	
mother: high – father: low	0.5407***		-1.8016**		0.2718***	
	(0.093)		(0.839)		(0.026)	
mother: high – father: middle	0.3201***		-1.6305*		0.2793***	
	(0.060)		(0.844)		(0.015)	
mother: high – father: high	0.0248		-0.7203		0.1191***	
	(0.052)		(0.877)		(0.013)	
Prince Edward Island	0.2137**	0.4900***	0.2868	0.4478	0.2933***	0.8382***
	(0.090)	(0.138)	(0.589)	(0.887)	(0.060)	(0.084)
Nova Scotia	-0.1125	0.4962***	0.9442*	-0.6742	0.0975***	0.5059***
	(0.075)	(0.131)	(0.563)	(0.819)	(0.034)	(0.049)
New Brunswick	0.0015	0.5599***	-0.0523	0.6854	0.2367***	0.4771***
	(0.073)	(0.116)	(0.532)	(0.775)	(0.036)	(0.049)
Quebec	-0.0902	0.4154***	0.2454	0.2639	0.1857***	0.4784***
	(0.065)	(0.111)	(0.401)	(0.669)	(0.028)	(0.040)
Ontario	0.0347	0.6803***	0.3125	0.2122	0.1667***	0.6212***
	(0.063)	(0.107)	(0.376)	(0.666)	(0.027)	(0.039)
Manitoba	0.1047	0.7335***	-0.0949	-0.1548	0.2603***	0.7151***
	(0.076)	(0.116)	(0.478)	(0.756)	(0.033)	(0.044)
Saskatchewan	0.2096***	0.7111***	0.0758	-0.6118	0.3329***	0.7863***
	(0.072)	(0.117)	(0.480)	(0.813)	(0.033)	(0.045)
Alberta	-0.0267	0.8255***	0.1101	0.2092	0.1348***	0.7439***
	(0.069)	(0.114)	(0.433)	(0.698)	(0.029)	(0.041)
British Columbia	-0.0762	0.5955***	-0.4523	0.6407	0.0867***	0.6303***
	(0.072)	(0.120)	(0.445)	(0.691)	(0.029)	(0.041)
trend	0.1097***	0.0636**				
	(0.018)	(0.029)				
child age = 1	0.2852***	0.2674***	0.5670**	0.8378**	0.2341***	0.1953***
	(0.039)	(0.062)	(0.261)	(0.384)	(0.010)	(0.014)
child age = 2	0.3029***	0.3227***	0.9347***	0.7932*	0.3214***	0.2838***
	(0.046)	(0.073)	(0.292)	(0.412)	(0.012)	(0.016)
child age = 3	0.3788***	0.4230***	0.8062***	0.7247*	0.3500***	0.3364***
	(0.046)	(0.073)	(0.284)	(0.406)	(0.014)	(0.018)
child age = 4	0.3340***	0.4464***	1.0164***	0.7912	0.4238***	0.4299***
	(0.056)	(0.093)	(0.310)	(0.515)	(0.016)	(0.019)
mother's age	0.2286***	0.1921***	-0.2452	0.2953*	0.1971***	0.2309***
	(0.040)	(0.049)	(0.279)	(0.175)	(0.009)	(0.009)
squared of mother's age	-0.0030***	-0.0026***	0.0023	-0.0047*	-0.0026***	-0.0031***
	(0.001)	(0.001)	(0.004)	(0.003)	(0.000)	(0.000)
father's age	0.0544	0.0330	0.4641**	-0.1489***	0.0191**	0.0149*
	(0.037)	(0.049)	(0.222)	(0.051)	(0.008)	(0.008)
squared of father's age	-0.0009*	-0.0007	-0.0054*	0.0023**	-0.0004***	-0.0004***
	(0.001)	(0.001)	(0.003)	(0.001)	(0.000)	(0.000)
constant	-4.8125***	-4.5850***	5.0600	-5.1082*	-3.4245***	-4.7204***
	(0.565)	(0.685)	(4.501)	(2.802)	(0.133)	(0.133)
N	18,889	7,667	313	189	161,860	92,510

Note: this table shows the estimation result of the probit model to predict the propensity of the mother to work in the absence of the policy; the model is estimated solely on the pre-policy sample, separately by the mother's education. Data: NLSCY waves 1-7 (1994-2006), 0-4 years old children in two-parent families, and GSS (1998,2005,2010) and Census (1996,2001,2006), two-parent families with at least one 0-4 years old child, both parents at most 50 years old.