The time-use of Canadian immigrant families: differences in time inputs on child raising.

by

Allison Mascella

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Examining Committee Membership

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

External Examiner:	Miana Plesca Associate Professor, Department of Economics and Finance, University of Guelph
Supervisor:	Ana Ferrer Professor, Department of Economics, University of Waterloo
Internal Member:	Kathleen Rybczynski Associate Professor, Department of Economics, University of Waterloo
Internal Member:	Pierre Chaussé Associate Professor, Department of Economics, University of Waterloo
Internal-External Member:	Martin Cooke Associate Professor, joint appointment Department of Sociology and Legal Studies and School of Public Health Sciences, University of Waterloo

AUTHOR'S DECLARATION

I hereby declare that this thesis contains material all of which I authored or co-authored: See Statement of Contribution included in this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

STATEMENT OF CONTRIBUTION

Chapter 2 is co-authored with my supervisor, Ana Ferrer. I contributed to Chapter 2 at all stages including the development of the research question, data selection, method choice, implementation of analysis and interpreting results. Chapter 1 and Chapter 3 are written solely by myself.

Abstract

This thesis contains three chapters in cultural effects and integration experienced by parents born abroad and their Canadian-born children empirically measured using daily time diary records.

Immigration policy introduced a point system to select immigrants in 1967. In the following decades, source countries for newcomers to Canada changed from predominantly U.S and European countries to the majority of newcomers now sourced from countries in which are more distanced culturally such as Asia, Africa and South America. Immigrant parents incur large initial settlement costs and, in many cases, may have dynastic motives for their children's future well-being as adults behind moving decisions. Current and future well-being and economic prosperity of children depends in large part on the nuances of decisions made by parents with respect to familial resources. This thesis investigates the time-use of foreign-born parents and their children as measured by their daily time-use records to learn whether their cultural background, as captured by source country region, and their integration into Canadian society affects time-use allocation decisions.

The focus of chapter one is on the inclination of immigrant parents to invest more (less) time with their children and on the measurement of the time inputs of their children into school related activities. Time spent by parents with their children is an input into the production function for children's cognitive and non-cognitive skill development. With increased time spent by parents, children experience boosts in IQ and non-cognitive skills which can impact future labour outcomes. I model this relationship considering both the participation and intensity of time-use decisions. By investigating the difference in daily time spent with children, I find that conditional on participation, Asian parents spend between 37 and 22 more minutes on education related activities with their children on a daily basis than their Canadian-born counterparts. Moreover, Asian fathers are 10% more likely to participate in education related activities with their children than Canadian-born fathers, while Asian mothers are equally likely to participate than Canadian-born mothers. Given participation, South-Central American mothers and European and African fathers are each spending around 20 more minutes on education activities with their children than their Canadian-born counterparts. Both the children of Asian-born and African-born parents spend at least over 46 more minutes on homework activity than students with both Canadian-born parents. Although no difference by area of origin is apparent in the total care-time parents provide for their children, there are

significant differences in terms of time specifically devoted to human capital investment activities by immigrant parents, and in the amount of time the children of African and Asian immigrants devote specifically to the completion of homework.

The second chapter considers that the time parents spend with their children could be a compensating factor for household income deficits. Household income is a commonly used factor to measure the well-being of children and gage their prospects as adults. However, a broader interpretation of well-being is being adopted in Canada and Europe, which includes non-economic dimensions that center around support for family and relationships as part of strategy for economic growth. Current empirical evidence documents financial hardships experienced by adult newcomers to Canada with respect to otherwise similar Canadian-born adults. This fact suggests that the competing nature of a parent's time into labour and household activities may be particularly relevant for immigrants. I use a CES utility function to estimate a two-dimensional poverty line that allows for compensation of an abundant resource (time) to become non-poor in a multidimensional sense. We find that immigrants parents are more likely to be poor in income, but not in time spent with children and although they are 2.5-5% more likely to be simultaneously poor in both time and income, only about 4-7% of immigrant parents spend enough time with their children to sufficiently compensate for income deficits. These results redefine poverty status for immigrant groups since they indicate that immigrant parents place a high value on this time (over labour activities). This could be due to lack of sufficiently valuable employment opportunities or a lack of adequate support network that provides quality time spent with children.

Chapter three addresses the interdependence of several categories of time allocation, as mediated by the immigration process and gender. Paid work and the decision to trade-off with leisure and other household duties has changed significantly in households over the past 50 years with the incorporation of women into the labour force. Traditionally, economics modelled time-use decisions with dichotomous labour-leisure choices. This resulted in family decisions where the highest wage earner specialized in work outside the household. However, recent research in children's development highlighted other essential categories of pertinent family time-use, such as care provided to children. The decision to work and, at the same time, raise children, forces changes to the traditional economic plan of time-use with notions of opportunities for women to specialize in both critical aspects of family functioning and the need of fathers to be involved in child rearing. I model four categories of

time-use – paid work, household production, leisure and child service – by a Seemingly Unrelated Regression Model (SUR) with particular focus on the immigrant integration process as mediated by gender. Compared to mothers born in Canada, mothers from Africa, Asia, Europe, and South-Central America spend up to 50 minutes less in daily leisure time, but there is not a significant difference in time spent with children. The result vanishes for Asian and South-Central American mothers once I control for years since migration, suggesting that sacrificing leisure may be involved in the process of integration. Parental time-use decisions play a role in the intergenerational mobility of children and as such, I also model four categories of time-use spent by young adults as I do for parents, but with time spent on total education activities – attending classes, finishing assignments - in place of child service with particular focus on time spent by young adults with a mother or father born abroad. I find that second generation young adults with Asian mothers or fathers are spending 41 and 31 less minutes in paid work and 54 and 58 more minutes on education activities and, likewise for young adults with a European mothers or fathers, 41 and 16 less minutes and 27 and 23 more minutes respectively. These results support previous research indicating that aspirations and expectations of parents and their children can vary by culture.

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I would like to especially express my gratitude to my thesis supervisor, Professor Ana Ferrer. With excellence in labour economics, Professor Ferrer fostered my understanding of the intuition which bridged the gap between the theoretical to the applied results. And for Professor Ferrer's encouragement to complete my dissertation, as without your steady determination and (sometimes requested by me on an impromptu basis) support, I don't think this dissertation would have happened.

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Table of Contents

List of Figures

List of Tables

Chapter 1 Education time with children and young adults: Immigrant- Canadian born differences

Allison Mascella

1.1 Introduction

Within economics, studies often concentrate on the outcomes and well-being of adults rather than on the happenings within the family in creating the outcomes of next generations. However, understanding time-use decisions made by parents is important because evidence suggests that the quality of the family environment has a greater influence on IQ and non-cognitive skill formation than schooling (Cunha et al., 2006). The quality of the environment provided by parents can strongly predict children's productivity as adults and, ultimately, contributes to success in the workplace (Knudsen et al. 2006). Many factors affect time-use decisions of families and cultural background is one them. Immigrants for instance, may have dynastic motives to undertake the high costs of immigration with the wellbeing of their children in mind, rather than their own, which could translate into high intensity human capital investments spent on the next generation. In countries with large immigrant populations, this could translate into differential investments on children that impact the well-being of families. The goal of this study is to learn about parental time inputs in caregiving activities with children and whether the inclination to do so is different for certain immigrant groups with respect to native-born Canadian parents. I link these differences in time spent with children by immigrant origin to the activities of students by analyzing the time spent on school related activities depending on their parental immigrant group with respect to students with a native-born Canadian parent.

The data used for this study is the General Social Survey (GSS) in years 1986, 1992, 1998, 2005 and 2010, which are the cycles with a time-use focus with activity codes for education-related activities with children. Time-use data gives parent's actual time allocations as well as socioeconomic and demographic characteristics which provide details of a child's family environment. It allows to construct direct measures of time spent in different activities from time-use diary information where respondents provide a log of the actions and amount of time spent on those actions over a 24-hour period.

To compare incidence and intensity of time-use, I use the Cragg model for education and total care activities in order to assess differences in inputs provided to children by immigrant parents relative

to those of parents born in Canada. Estimates suggest that, given that they invest in educational activities with their children, parents born in Asia and South Central America are spending approximately 18 and 27 more minutes per day in these activities respectively, relative to investments of Canadian parents. Asian fathers are 8 percent more likely to participate in education activity and, conditional on participation, spend 22 more minutes on education related activities with their children compared to fathers born in Canada. Fathers born in Europe and Africa spend 20 and 26 more minutes than fathers born in Canada conditional on participation. Results from the Cragg model are compared to the results using Tobit and OLS regression, which are popular models used in time-use literature.

The Cragg model is used again to estimate the effect of parental origin on the time investments of students on total school and homework activities. Estimates suggest that students with Asian mothers and fathers are both around 15 percent more likely to participate in homework activity and, given that the student does participate in homework activity, spend approximately 48 and 43 more minutes per day respectively completing homework than students with Canadian parentage. The results are robust to the presence of parents in the household. Students with a mother or father born in Africa spend around 67 and 47 more minutes intensely doing homework than students with a mother or father born in Canada. Students with mothers from Europe are 13 percent more likely to participate and students with a father from Europe are 10 percent more likely to participate in homework. These estimates can be interpreted as the cultural preference or the parent's inclination toward the generation of cultural or social capital of their children.

The next section describes the immigrant landscape in Canada and research related to the generational transmission of economic outcomes, children's skill development and the influence of the family environment as well as related time-use studies on the family. The data section describes the GSS and provides a statistical overview of immigrant and Canadian-born parents as well as students in Canada by their generation status. The fourth section describes the unique difficulties and modelling choices for time-use data. The fifth section analyzes the results and the final section concludes with a discussion on conduct for public policy.

1.2 Literature Review

This study is on the time provided by parents for their children in the form of educational activities such as reading or helping with homework and whether the time allocated by parents who are immigrants is different from Canadian-born parents. The time devoted by students to school related

activities is also compared for differences in time allocated by second generation immigrant students to that of students with Canadian-born parents.

The motivation for the distinction of a child's experience raised by immigrant parents as opposed to Canadian-born parents begins with the change in immigrant source countries and the observed gaps in earnings of first generation immigrants and the implications of those gaps on the outcomes and intergenerational mobility of second generation immigrants. From the 1965-1969 cohort of immigrants, about 65% of male immigrants were born in northern, western, or southern Europe and 13% in Asia and from the 1995-1999 cohort, the source countries switch to 54% born in Asia and only 14% northern, western, or southern Europe. There are similar shifts in region for women. Notably, immigrants from newer source regions earn less in the Canadian labour market than those from European regions with similar characteristics. Earnings of successive cohorts have deteriorated by as much as 50% to 60% less than their Canadian-born counterparts (Aydemir and Skuterud 2005).

Newcomers can incur large moving costs of migration and, in many cases, with the motivation that it is likely to benefit their children's future in the form of increased opportunity and living standards. The link between parental inputs and child outcomes are not determined solely by family background characteristics but determined, in part, by aspirations and values held in the household (Corak 2008). Canada is held in high esteem internationally due to its support of immigration. To analyze the link between parental and child economic outcomes, time-use decisions at the household level should be considered. Societies with large immigrant populations can track the outcomes of the children of immigrants as a test of the degree of integration, and differences in time-use patterns can illustrate any cross-generational transmission of social and economic status between immigrants and their children, the second generation.

Intergenerational mobility is a measure of the economic integration of the children of immigrants. Empirical literature finds that the strength of the connection between parent and child education and earnings can vary by group (Corak 2008, Corak 2009). Corak (2008) finds that parents with a university degree or more have a strong tendency to pass on the same education level in families headed by either immigrant or Canadian-born parents however, the Canadian-born children of almost all immigrant communities with relatively lower education levels, attain more years of schooling than the Canadian average. The author explains that this outcome for second generation children is considered to be due, in part, from the notion that immigrant parents are more "educationally inclined"

regardless of their education level[1]. Measuring the earnings elasticity between immigrant fathers and second-generation immigrant sons, Aydemir, Chen and Corak (2009) do not find a difference in the estimate for the immigrant population in Canada than the rest of the population.[2] However, the authors then decompose their elasticity estimate into the contributions from the influence of education and from the influence of social capital, which they measure by average earnings of fathers from the same country, and find that the influence on earnings is mostly driven through channels of social capital. Further, the authors find an intergenerational reversal of earnings between immigrant fathers and second-generation sons and daughters with generational earnings elasticity to be strongly positive at the lower end of the income distribution, flat in the middle and negative at the top. This means that the children of parents with below-average earnings become above-average earners in the next generation and that parental education is important for tackling disadvantages.

There is a caution as to not interpret the estimate of generational mobility as a measure of equality of opportunity (Roemer 1998, 2004 as cited in Aydemir et al 2009). The correlation found between the outcomes of parents to the outcomes of children could be due to family culture and investments having an influence on the skills, beliefs, and motivation of the next generation. Furthermore, an environment that breeds success may be more effective in one group than another (Corak 2009). This implies that family and community resources can nurture characteristics like goals and determination or offer networking opportunities for access to schools and jobs. Time-use studies provide evidence of behaviors and practices in the home environment surrounding the care of children and functioning of the family. It is possible that differences in the inclination to pass on to children the values and behaviors that encourage children to obtain higher levels of education, which is considered to be stronger among immigrant families than among families with both parents Canadian-born, can be exposed with time-use data at the household level.

The time parents allocate to their children has changed in the last decades. Sayer, Bianchi, and Robinson (2004) and Altintas (2016) assess the trends in parents' time spent with children and their results indicate that parents have altered their behaviour in such a way that they are spending more total time caring for children than in previous decades. Mechanisms for this increase are explained by Sayer

[1]Corak (2008) results are from the 1981 Census for respondents who had children aged 5 to 17 years and from the 2001 Census who were males aged 25 to 37.

[2] The authors explain that this result contrasts with Borjas (1992) who that finds a significant elasticity between parent and child education among second generation immigrants born to immigrant parents.

et al (2004) as the expectation of what children can achieve given the proper inputs has increased with the level of affluence over time. Pressure to relay rich inputs to their "more precious" and fewer children, so that parents seem like "good parents". And the mechanism that parents today could be a selected group on the dimension of wanting to spend time with their children because parenting doesn't just happen anymore, but it is for those who are eager to have the experience of parenting and thus are choosing to spend more time with their children.

These mechanisms can perhaps be applicable to the personal ambition or familial goals of a newcomer to Canada. Making the costly decision to relocate with the motivation of opportunities for their children may translate to providing extra time to help navigate and excel in the new unfamiliar schooling and community system as a "good parent". Empirical studies in time-use can expose differences in the patterns of time spent along socioeconomic and parental characteristics and specifically, by tracking immigrant-native born differences in time-use along these determinants can perhaps provide context to differences in immigrant-native born outcomes.

There is evidence in the literature that differences in parental practices and aspirations can account for differences in children's academic achievement. Astone and McLanahan (1991) question if school-related parenting practices are associated with children's school outcomes and find that their measures of parental practices are related to most of their school achievement indicators. The authors find that parent behaviour variables of general supervision, parent aspirations and father monitors progress is positive and significant in predicting every academic outcome except father monitors progress in predicting diploma/GED by 1986. Mother monitors progress is positive and significant in every academic outcome except wants college, which is negative and insignificant and attitude toward school which is positive and insignificant. The parent behaviour of talking with the child at least weekly is positive and significant in predicting that the child maintains grades and has a positive attitude toward school. Further, Zick et al (2001) find that increases in the frequency of reading/homework activities and playing/project activities by parents with their children are related to higher grades. The authors continue by explaining that parents not only have to hold high aspirations, but to be effective, they must also transmit aspirations to their children through a feeling of closeness and supervision coming from their parent.

From the perspective of child development, understanding time allocation decisions made by parents is important because the quality of the family environment has an influence, which Cunha et al (2006) suggest is more important than schooling in the process of IQ and non-cognitive skill formation. The construction of the brain and formation of skills during a child's development are influenced by an

interaction of genetics and life experience and the attainment of competencies are interdependently built on genetics and foundations made early in life. The quality of the environment chosen by parents can strongly predict children's productivity as an adult and ultimately contributes to success in the workplace (Knudsen et al. 2006). In investigating the production of early childhood skills, Fiorini and Keane (2014) define a production function for children's cognitive and non-cognitive skills that has an explicit entry for children's time use and shows that educational activity with parents is the most productive input in determining vocabulary test results. Therefore, focusing time-use research on education in the home environment can expose differences in human-capital building inputs, which can ultimately impact the future outcomes of children. Inclinations to participate-in or provide intense amounts of time can provide evidence of the difference in aspirations and motivations by culture and can provide context on the outcomes of second-generation immigrants.

This research project provides an exact measure of time spent on total care with children and of total time spent by students on school activities and in particular, on educational activities outside the classroom as a measure in the creation of human capital. There has not yet been a study which profiles immigrants' time use with a focus on time allocated to educational activities with children and compares results to native-born Canadian parents as a benchmark. Considering time-use data used to measure time allocation decisions in the home environment and, using the definitions proposed, represents an investment in a child's environment. Since the quality of the family environment is an important influence in life cycle skill formation and strongly predicts children's productivity as an adult and intergenerational mobility is found to differ by immigrant group, studying the investments in a child's environment can help to understand what fosters intergenerational earning mobility and educational attainment over the life cycle. Ribar (2013) also explains that diversity in groups and in contexts can produce diverse results and gives advice to show the diversity among certain immigrant groups as well as noting that there is little work, besides health status and work hours, existing in the literature on immigrant time use.

The next section describes the data used in this study and the definitions I use for education and total care activity of parents for their children and to measure the outcomes of students, the definitions I use for homework and total school activity.

1.3 Data and Summary Statistics

The data I use is from the General Social Survey time-use cycles, 1986, 1992, 1998, 2005 and 2010. The target population of the survey is individuals 15 years of age or older residing in private households in Canada excluding residents of the Yukon, Northwest Territories, full time residents of institutions and individuals without phones. The GSS in these 5 selected survey years contacts households by telephone to record one 24-hour time-use diary. Any household member over the age of 15 is eligible to be chosen randomly as a respondent amongst household members. For random allocation across days of the week and months of the year, the survey is designed so that each respondent is randomly assigned a "designated day" over a 12 month period from the month of February in the survey year to January the following year.[3]

The time-use questionnaire records all actions performed by the respondent and the associated time duration of that action for one record of 1440 minutes (or 24 hours) per respondent. The actions are classified into three digit activity codes by the interviewer and can be summed by code over the 24-hour period to compute total daily minutes spent on each activity. If the respondent reports more than one activity, the interviewer asks the respondent to determine which activity was the main activity. If a few activities are broken up and intermingled, then the interviewer makes one entry for each activity and enters the total time for each.[4]

This study has two parts. First, I use a sample of parents to study whether immigrants make different time investments on their children than native born Canadians. Second, I use a sample of students to track any effect on schooling outcomes for those whose parents come from places that make, on average, larger time investments on their children.[5] I define immigrants as respondents born outside of Canada, second generation immigrants as respondents with at least one parent born abroad and with both parents born in Canada, I define as the third-plus generation. Further, I decompose the immigrant indicator into a set of seven controls for the respondent's place of birth organized by geographic region. These regions are Canada, South Central America, Asia, Europe, Africa, Other and, included in one region, United Kingdom, Republic of Ireland and the rest of North America. For second-generation

[3] Cycle 2 1986 was collected during the months of October to December.
[4] For example, if the respondent says, "For 20 minutes I made dinner and also helped with homework for 30 minutes then took dinner out of oven for 2 minutes.", then this is recorded as 30 minutes of helping/teaching/reprimanding household children and 22 minutes of meal preparation.
[5] Activity codes for caregiving in educational activities are not available in GSS time-use Cycle 29 2015 so that cross section cannot be pooled in the data set used in this paper.

immigrant students, I decompose their indicator into the same set of seven controls, but by their parent's birthplace.

The survey years of the GSS I use for both parts of the analysis is a general survey in that the time diaries collected are not for a specific group of individuals or for a particular faucet of their life. For example, the Longitudinal Study of Australian Children (LSAC) asks parents to record children's time-use diaries and administers children's cognitive and noncognitive skills testing. This is an advantage of the GSS because parental time spent with children and students' school time might be more accurately recorded as there is no incentive to over-report time in this genre.

1.3.1 Parent Sample

The sample of parents selected for the first part of the analysis is parents with at least one child in the household and the youngest child is no older than 14 years. This choice is guided by the definition of care in the activity codes for caregiving minutes, which distinguishes between care recorded for children in the household (aged 0 to 14 years old) and care minutes recorded for household adults (those aged 15 years of age or older). The full sample of parents contains 16,779 observations of which 9,859 are mothers and 6,920 are fathers.

The first dependent variable of interest in the parent sample is defined as "Total child care" and it is the total duration in minutes spent by parents on all care activities for children aged 0 to 14 years. Examples of the activities included in this variable are bathing children, feeding children, and administering medical care for children. The second dependent variable of interest is a subset of "Total child care" which I define as "Education" and it is the total duration in minutes spent by parents on education related activities for children aged 0 to 14 years. Examples include activities of time spent teaching children, reading to children and communication related to a child's school activities (See Appendix A, Table A1 for GSS activity codes used to define "Total child care" and "Education").

Table 1-1 shows the average number (and associated t-statistics) of minutes spent on daily total child care and education activity - by immigrant status - in panel A and B respectively. The p-value from a t-test of equal means by immigrant status is also reported in Table 1-1. Average minutes spent daily on total care activities are 98.51 and 94.55 minutes per day for immigrants and Canadian-born respectively and the null hypothesis of the two groups having the same mean can not be rejected. However, immigrant parents spend, on average, more time on education activities with their children than Canadian born parents with 18.71 minutes versus 14.33 minutes per day respectively, and, in this case, I reject the null hypothesis of the two groups having the same mean. These results suggest that

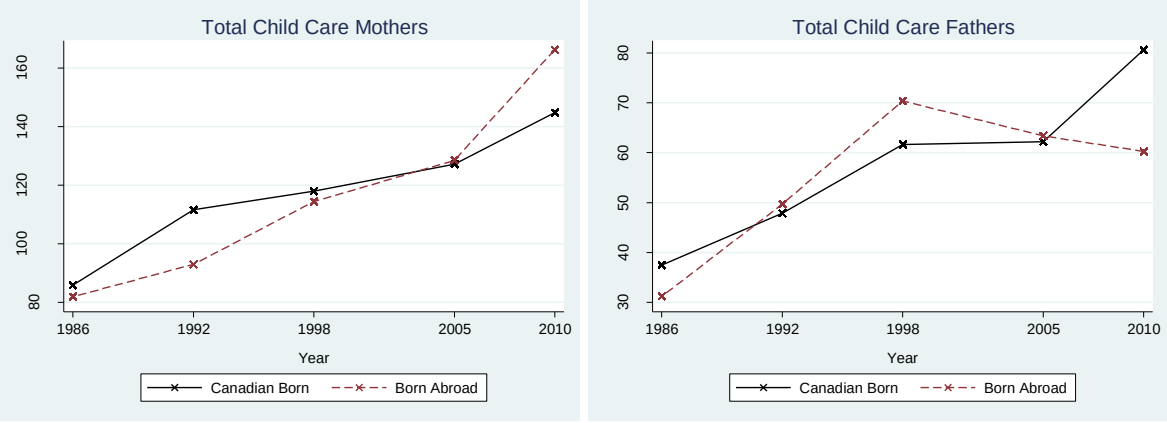
there is, on average, a potential difference in immigrant families, which is specific to education related activities in comparison to overall childcare provision. This finding motivates the analysis to explain the determinants of these two variables separately and how they are different for families living in Canada by parent region of origin.

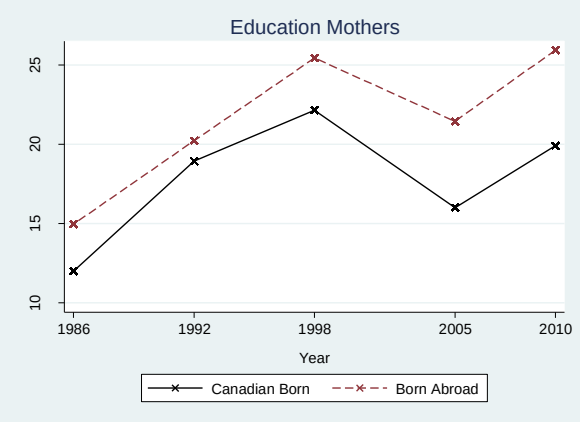
Table 1-1 Summary Statistics Time-Use Variables Minutes Spent Per Day.

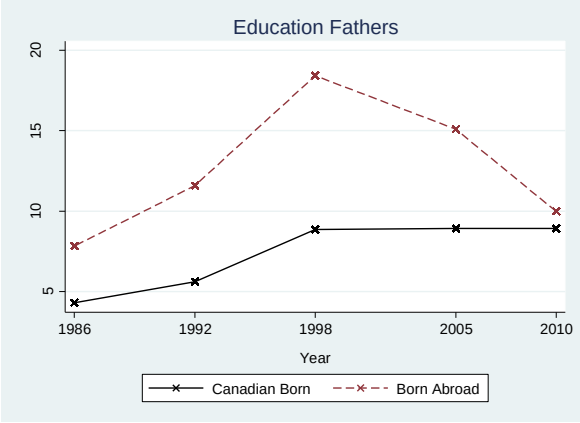
Parents **Total Child Care**			
	Obs.	**Mean**	**Std.Error**
Canadian Born	14,034	94.99	0.99
Born Abroad	2,745	98.51	2.42
T stat = -1.3486; P-value = 0.1775			
Parents **Education**			
	Obs.	**Mean**	**Std.Error**
Canadian Born	14,034	14.33	0.30
Born Abroad	2,745	18.71	0.84
T stat = -4.9298; P-value = 0.0000			
Students **Total School**			
	Obs.	**Mean**	**Std.Error**
Third+ gen.	3008	265.34	3.97
Second gen.	815	281.17	7.85
T stat = -1.7985; P value = 0.0723			
Students **Homework**			
	Obs.	**Mean**	**Std.Error**
Third+ gen.	2,971	94.32	3.56
Second gen.	418	126.03	8.91
T stat = -4.1480; P-value = 0.0000			

To track average minutes spent over the sample period, in Figure 1-1 I plot the average minutes spent in education and in total care activities by gender and place of birth. As in Sayer, Bianchi, and Robinson (2004) and Altintas (2016), I find that the total time parents spend on caregiving activities with their children has increased over time. Like total time in childcare, I find that the average time spent on education activities has increased as well as parents born abroad appear to spend more minutes on average in education activities compared to Canadian born parents in each survey year. This increase provides corroborating evidence with the literature and the difference in education activities provides further motivation to explain the determinants of education activities.

Figure 1-1: Average Minutes Per Day Spent by Parents by Year and Place of Birth.







To characterize the distribution of minutes spent by parents on these two time-use categories, I estimate kernel densities for mothers and fathers by immigrant status on the full distribution and on the distribution restricted to nonzero observations in Figure 1-2. The kernel density estimates show that both variables have a focal point at zero and this peak is higher for Canadian born parents of both genders however, restricted to nonzero observations, the probability of spending more than approximately 110 and 40 education minutes is notably higher for mothers and fathers born abroad compared to Canadian born parents respectively. Characterizing the distribution provides further motivation for distinguishing education minutes provided by parents as a separate time-use category with a focus on parent's place of birth. The number of non-zeros observations for total child care for mothers is 79% (or 7,835/9,859) and for fathers is 55% (or 3,822/6,920) and the number of non-zeros observations for education is 32% for mothers (or 3,196/9,859) and for fathers is 16% (or 1,101/6,920).

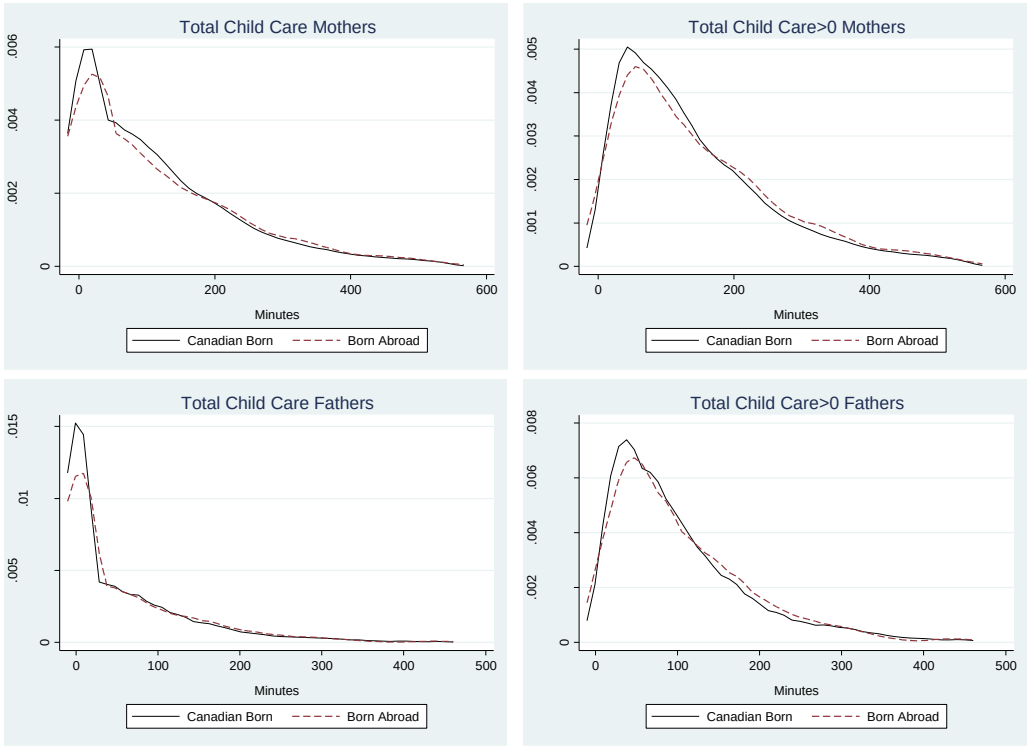
The literature on immigrant assimilation often makes a distinction between immigrants that arrived as adults and immigrants that arrived as children, or on the number of years since first migrated. The notion behind this distinction is that a person will gain understanding of the culture in the new country with each year spent in the host country, including social norms and practices. That is, the distinction might be sharp in early years of migration, but after adaption, the difference in parenting practices might become negligible. Including a control for years since migration and years since migration squared in the set of determinants allows for estimates of the regional effects net of

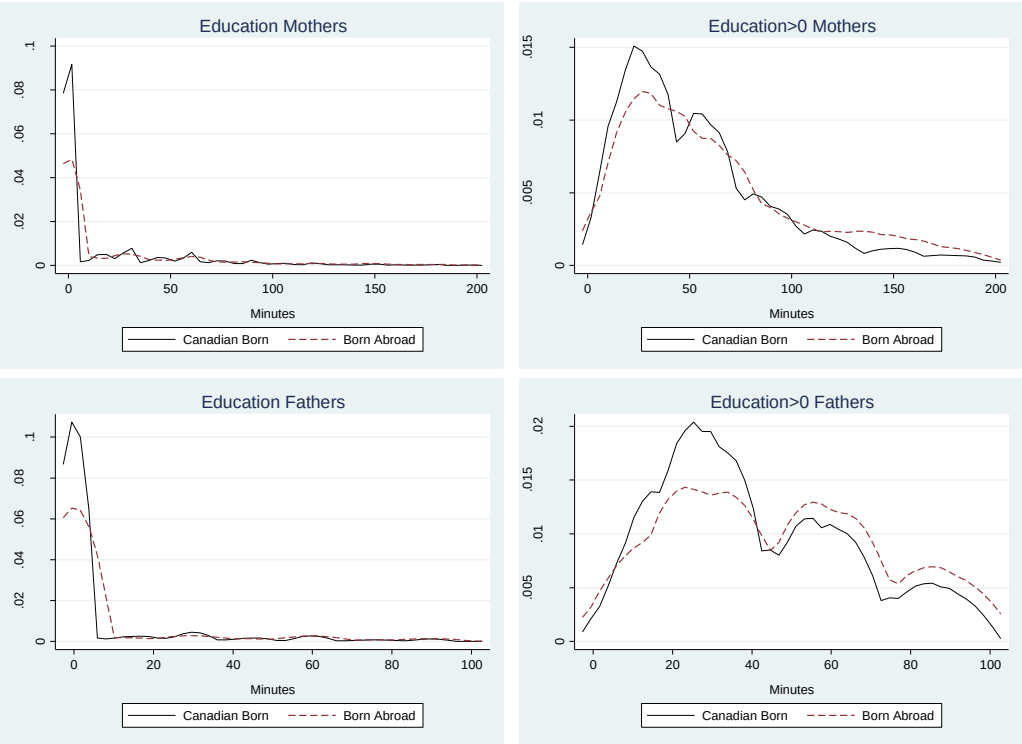
assimilation and including years since migration squared captures the possible non-linearity in the relationship between years since migration and parents' time inputs.

The gender of the parent responding to the survey is also of interest because men and women are historically driven toward different tasks in the household. Following Sayer et al (2001), Zick et al (2001), Baker and Milligan (2013) and Guryan et al (2008), I present results separately for men and women, to account for perceived gender roles.

To observe the regional effects net of the respondent's human capital, I use the respondent's age, education and, if the respondent is born outside of Canada, their years since migration and years since migration squared. To account for detailed family composition and background characteristics, I include indicator variables for the parent being a lone parent, if the youngest child in the household is aged less than 4 years old, if there are three or more generations living in the household and a continuous variable for the number of children in the household. The total number of children in the household and the age of the youngest are included to account for the uniqueness of family composition and its influence on how parents may allocate their time accordingly. Zick et al (2001) find that, as the

Figure 1-2: Density Plots Minutes Per Day Spent by Parents by Place of Birth.





number of children in the household increases, mothers increase their frequency of reading with and/or helping children with homework and explain that this may be appealing because it is an activity that can be done simultaneously with more than one child. Similarly, the age of the youngest child could alter the decision on the type of care to offer. Sayer et al (2001) find that families with a preschooler in the home spend more time on primary care compared to those without a preschooler present.[6] The number of work hours is used to control for variation in parental time availability.

Sayer et al. (2004) report the existence of trends overtime in the care parents give their children. Suggesting that the time parents devote to activities with their children would not be the same every year. For instance, it could be the product of some other trend that impacts a specific gender (like differences in the suitability of women's work outside the house) or a specific period of economic activity (such as recession or an economic boom). To account for this possibility, I include a set of controls for survey year.

I also include a set of controls for the education level of respondents. An early study by Murnane, Maynard and Ohls (1981) found that mother's education is positively related to children's

[6] The child's gender would be of interest, as a vast literature links investment activities on children with the sex of the child however, the gender of children are not available in GSS.

achievement using a sample of low income families. Mothers with an education level of high school or more are found to have a positive relationship with students' cognitive skills, whereas mothers with less than high school do not. More recently, Zick et al (2001) find that mothers and fathers with higher levels of education increase the frequency of reading and/or helping with homework activities and conclude that parents with higher levels of education must be placing a premium on devoting time to these educational activities. Guryan et al (2008) also find a positive relationship between parental time allocated to children and education using US time-use data which they term the "education gradient".

Table 1-2 displays the proportion of immigrant and Canadian born parents across age, education levels and partnership status as well as the average number of work hours reported by the respondent on the diary day. The sample of immigrant parents appear to be older, have higher levels of education and slightly lower rates of lone parent partnership status. By each gender, immigrant parents worked similar hours on average.

Table 1-2: Summary Statistics Parents by Place of Birth (SE) n.

	Mothers		**Fathers**	
	Canadian Born	Foreign Born	Canadian Born	Foreign Born
15-24 yrs.	0.10 (0.009) 566	0.04 (0.034) 39	0.03 (0.007) 136	0.02 (0.017) 6
25-34 yrs.	0.48 (0.016) 3,471	0.34 (0.03) 494	0.44 (0.019) 1,956	0.23 (0.033) 228
35-44 yrs.	0.36 (0.016) 3,457	0.47 (0.038) 823	0.40 (0.19) 2,719	0.60 (0.041) 615
45-54 yrs.	0.06 (0.009) 757	0.14 (0.03) 220	0.10 (0.013) 849	0.13 (0.029) 275
55plus yrs.	0.00009 (0.0007) 23	2.68e_06 (1.16e-06) 9	0.03 (0.009) 100	0.02 (0.013) 36
Less than High School	.34 (.016) 1,577	.38 (.039) 221	.39 (.019) 1,223	.36 (.042) 171

High School	.250 (.014) 1,469	.19 (.030) 220	.18 (.015) 906	.14 (.028) 135
Some Post-Sec.	.489 (.011) 1,309	.14 (.024) 235	.16 (.013) 882	.11 (.025) 142
College Diploma	.156 (.012) 2,331	.14 (.024) 365	.15 (.013) 1,551	.13 (.029) 227
Bachelor Degree	.094 (.010) 1,307	.10 (.021) 382	.01 (.010 920)	.19 (.033) 283
Graduate Degree	.011 (.003) 281	.04 (.012) 162	.03 (.006) 278	.08 (.021) 202
Lone parent	.13 (.009) 4,050	.11 (.022) 930	.02 (.004) 3,014	.03 (.019) 726
Work hours	2.34 (.109)	2.89 (.303)	5.28 (.171)	5.96 (.362)
Observations	8,274	1,585	5,760	1,160

Note: Columns sum to 100% in age and education levels

1.3.2 Student Sample

For the analysis on academic habits of students, I create the dependent variables of "Total school" and "Homework". The variable "Total school" is the total duration in minutes spent by students devoted to their education, which is the sum of the activities listed under the heading "Class Activity" and "Homework Activity". Examples of "Total school" activity are activities like attending a guest lecture and attending university courses. The variable "Homework" is the total duration in minutes spent by students on activities outside the classroom like being tutored, participating in group study, and studying for exams. (See Appendix A, Table A2 for "Class" activity and "Homework" activity codes).

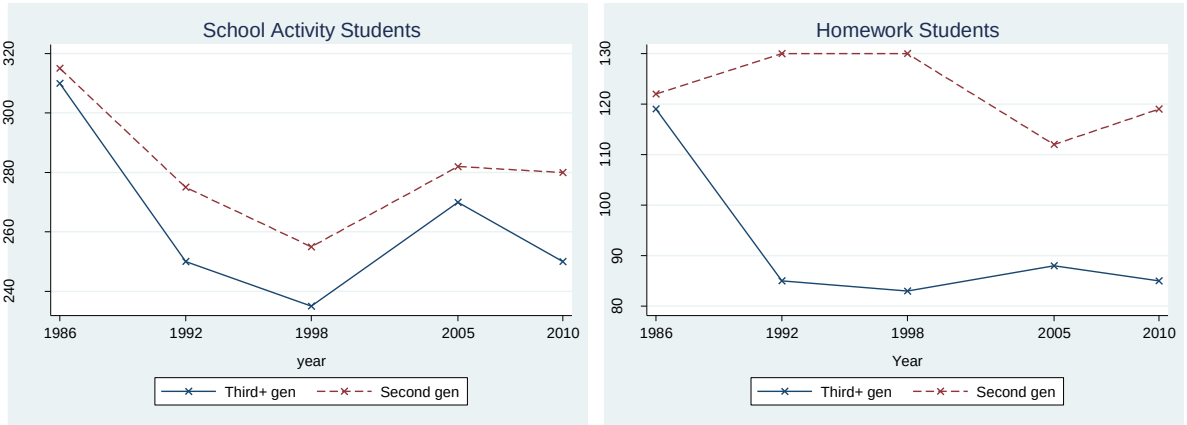
I select respondents that state their major activity as going to school and are between the ages of 15-25 years for a sample size of 3,389 students. The age restriction of students is determined by the lower bound of the GSS target sample of 15 years of age and I chose the upper bound to include post-secondary students.

The third and fourth panels of Table 1-1 show the average school activity and homework minutes spent by students daily, and associated t-statistics by generation status. The average number

of minutes spent on all school activity by students with one or both parents being an immigrant is 281.17 minutes per day and 265.34 for students with native born parents. Students who have at least one parent that is an immigrant are spending more time doing homework on average than students with both parents who are native born, which are 126.03 minutes 94.26 minutes per day respectively. I test whether the difference in the mean minutes spent on school activities is different amongst these groups and find that there are significant differences, as the null hypothesis of the average being the same between the two groups is rejected in both cases.

Average school activity and homework activity performed by students, I plot in Figure 1-3. Overall, average school activity appears to decrease in each survey year until 1998 with an increase in 2005 whereas average homework activity has remained relatively stable for second generation students and decreased in 1992 for the third plus generation and then remained relatively stable thereafter. Second-generation students appear to spend more time on average in both activities compared to the average for the third plus generation in every survey year. This apparent difference by generation status further motivates the analysis on the determinants of student activity.

Figure 1-3: Average Minutes Per Day Spent by Students by Year and Generation Status.



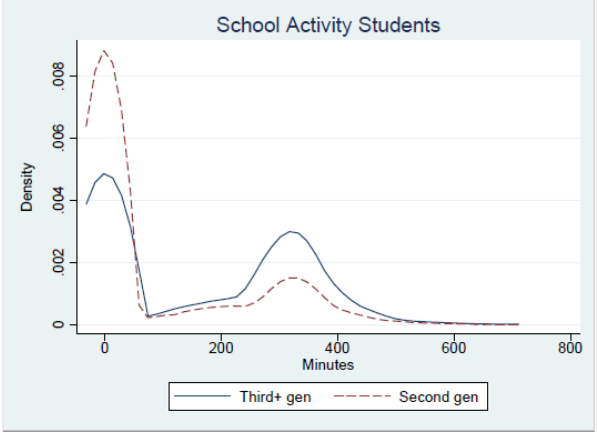
In Figure 1-4 I estimate kernel densities by generation status for the distributions of student time-use variables and for the distributions restricted to nonzero observations. Minutes for total school

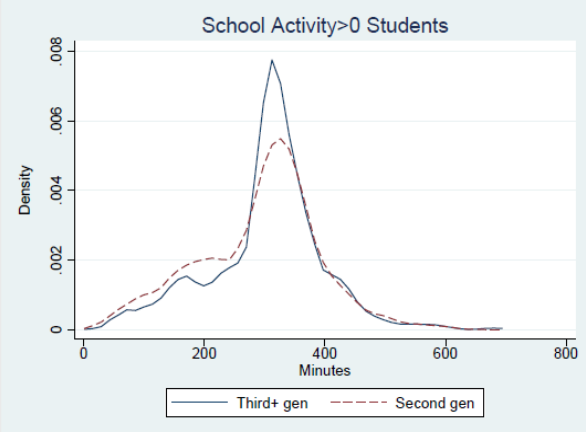
activity looks distinctly bimodal with a mass at zero and at around 350 minutes. Restricted to the 73% (or 2,776/3,823) nonzero observations, the distribution looks more dispersed for second generation students with a mass at 175 minutes which is above then at 350 minutes which is below that of third plus generation students. The homework activity variable has a mass at zero and restricting the distribution to the 55% (or 2,098/3,823) nonzero observations, there is a mass at around 85 minutes which is below for second generation students but above thereafter compared to third plus generation students. By characterizing the distributions of students with at least one parent born abroad, I find that there are more students reporting a higher level of homework minutes compared to the distributions for students with Canadian born parents.

I describe the student sample across education levels, the presence of a parent living in their household and work hours on the diary day by generation status in Table 1-3. The sample of students with a mother and/or father who is foreign born has a similar proportion to students with both Canadian born parents at lower levels of education. Students with a college diploma are more represented among the students with Canadian born parents and students with the highest education level are more represented among students with a foreign born parent. The proportion of students living with their parent in the household is very similar comparing across students' parental immigrant status. Students with foreign born parents worked longer at their job on the diary day (65 minutes compared to around 30 minutes).

The next section discusses model choice and introduces the methodology and results are presented in the section that follows.

Figure 1-4: Density Plots Minutes Per Day Spent by Students by Year and Generation Status.


School Activity Students
Density
0
.002
.004
.006
.008
0
200
400
600
800
Minutes
Third+ gen
Second gen


School Activity>0 Students
Density
0
.002
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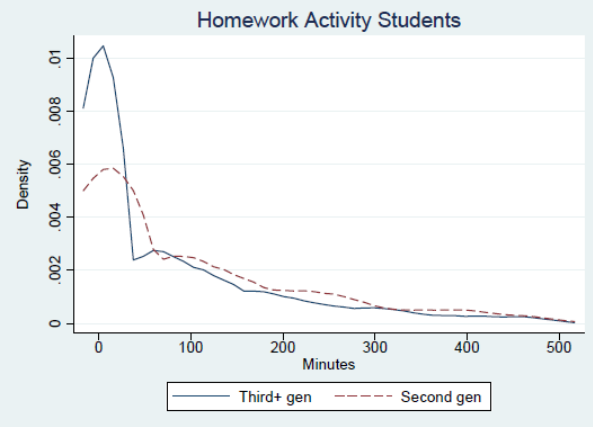
.008
0
200
400
600
800
Minutes
Third+ gen
Second gen


Homework Activity Students
Density
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.002
.004
.006
.008
.01
0
100
200
300
400
500
Minutes
Third+ gen
Second gen

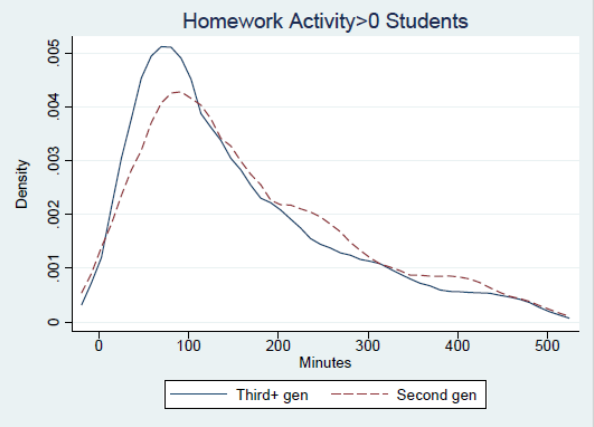

Homework Activity>0 Students
Density
0
.001
.002
.003
.004
.005
0
100
200
300
400
500
Minutes
Third+ gen
Second gen

Table 1-3: Summary Statistics Students by Generation Status (SE), n.

	Third+ Generation	Second Generation
Less than High School	0.60 (0.030) 1,879	0.61 (.050) 284
High School	0.03 (0.009) 131	0.02 (0.012) 27
Some Post-Secondary	0.30 (0.026) 998	0.27 (0.04) 191
College Diploma	0.04 (0.011) 120	0.003 (0.002) 11
Bachelor and Grad. Degree	0.03 (0.007) 147	0.11 (0.03) 35
Parent(s) in HH	.84 (.02) 2,552	.85 (.035) 116
Work Minutes	28.77 (4.59)	64.40 (15.07)
Observations	3,275	548

1.4 Model

Consider a model for a time-use demand equation,

$$y_i = \boldsymbol{x_i^T \beta} + \varepsilon_i \quad \varepsilon \sim N[\,0, \sigma^2] \tag{1}$$

with y_i as a time-use variable for respondent i. The time-use variables represented by y_i in (1) have a focal point at zero and are continuous thereafter as I show in figures 1-2 and in figure 1-4. The problem with estimating (1) by Ordinary Least Squares (OLS) using either the parent or student sample described above is a violation of the assumption that $E(y|x)$ is linear in *x*,

so the estimates of β in equation (1) are not consistent and the partial effects on $E(y|x)$ cannot really be constant over a wide range of *x* (Wooldridge , 2002).

The problem of an inordinate amount of zeros can be modelled by a limited dependent variable model or otherwise known as, corner solution model. It is specified as:

$$y_i^* = \boldsymbol{x_i^T \beta} + \varepsilon_i \quad \varepsilon \sim N[\,0, \sigma^2] \tag{2}$$

$$y_i = \begin{cases} y_i^* & if \;\; y_i^* > 0 \\ 0 & Otherwise \end{cases} \tag{3}$$

with error terms normally distributed with constant variance σ^2. The censoring mechanism (3) is the latent variable, y_i^*, where it's observed value, y_i , is a mixture of zero and nonzero entries. In this structure, the dependent variable is said to be censored from below with y_i being the censored version of, y_i^*, the latent variable. This means that if the individual has a positive propensity to engage in the activity, then $y_i^* > 0$ and I observe a nonzero entry of $y_i = y_i^*$ and if the individual has a zero or negative propensity to engage in the activity, then I observe a zero entry of $y_i = 0$. The set of $\boldsymbol{x}$ covariates are observed in entirety for both cases of the dependent variable.

The Tobit model is characterized by a corner solution model and fits the appearance of the density plots of the dependent variables in figures 1–2 and figure 1-4. Outcomes are completely observed and the likelihood function proposed is

$$f(y|x_1) = \left[1 - \Phi\left(\frac{\boldsymbol{x_1^T \beta}}{\sigma}\right)\right]^{1(y=0)} \left[(2\pi)^{-\frac{1}{2}}\sigma^{-1} exp\left\{\frac{-(y - x_1^T\boldsymbol{\beta})^2}{2\sigma^2}\right\}\right]^{1(y>0)} \tag{4}$$

where Φ is the standard normal cumulative distribution function and $1(y = 0)$ and $1(y > 0)$ are the indicator functions (Burke 2009). If the data generating process is as described in (2) and the censoring mechanism in (3), then the coefficients and marginal effects from Maximum Likelihood Estimation MLE of (4) will be consistent (Cameron & Trivedi 2009).

Tobit model assumes the zeros observed in the dependent variables for both parent and student time-use represents a true optimal choice of zero minutes to devote to their respective activity. This assumption might not be consistent with the duration of time over which time-use data is collected and with interpreting the estimates as long-run averages. That is, individuals who engage regularly in an activity like parents and total childcare or students and

school activity over the period of interest to the researcher, can just happen to not do so during the limited window of time covered by the time diary day and thus may be misidentified as nonparticipants. The zeros produced by the mismatch between window length of collection and true optimization period are not true corner solutions with an optimal value of zero, but are false non-participation entries, so the zero entries can represent measurement error of the dependent variable. (Forster and Kalenkoski 2013, Stewart 2013).

Time use data collected like the GSS with a short window length of 24 hours are subject to a mismatch between the length of time over which the survey collects diary data and the true horizon over which individuals make optimal choices to allocate their time. When respondents set their personal priorities for their optimum lifestyle it can be considered as measured in units of time that span a period of a week, month, or year. Then, on a daily basis, random events guide the allocation of those optimal amounts to daily activities. For example, during times of the year when young students do not have projects assigned so requiring no educational help from parents or days of the week when students are engaged in extracurricular activities so do not study that day. (Forster and Kalenkoski 2013, Stewart 2013).

In the case of a measurement error where the zeros are caused by picking the wrong days, both OLS and Tobit may produce inconsistent estimates. But if these days are random, OLS is preferred over Tobit. In the case the 0s indicate a true corner solution then, OLS is biased and inconsistent and Tobit model is preferred.

In addition to the Tobit model or OLS to estimate the coefficients in (1), a two-part model which allows for two separate mechanisms determining a respondent's decision to participate and the magnitude of participation fits the data as I show in figures 1-2 and figure 1-4. Since the partial effects of $E(y|x)$ are not constant over a wide range of *x*, the probability of participation and the magnitudes of participation are not constant for all values of *x*, so the two-part model might capture important behavior in determining time inputs in parental and student activity.

In comparison, the Tobit model implies that covariate x_j has partial effects on $E(y|x, y > 0)$ and $P(y > 0|x)$ that have the same sign. For instance, if covariate x_j has an effect on y that is pos./neg. but after some values of x_j the quantity of y might be pos./neg.

The Tobit model is constructed such that the process that determines participation is the same as the process which determines intensity. Tobit type 1 model also assumes that any two continuous covariates have the same relative effects on $E(y|x, y > 0)$ and $P(y > 0|x)$. For instance, if variable x_j has twice the effects as x_h on the probability of participation then x_j necessarily has twice the effect on the expected minutes invested for those individuals investing a positive amount of time.

Cragg's two-part model is used to obtain estimates of $E(y|x, y > 0)$ and $P(y > 0|x)$ (Cragg, 1971) and is the empirical model I select to discuss in the results section of both parent and student samples[7].

As explained by Burke (2009), the Cragg model integrates the Probit model, to determine the probability of $y > 0$ (and $y = 0$), and the truncated normal model for the expected value of y when $y > 0$. The likelihood function proposed is

$$f(w, y|\boldsymbol{x_1}, \boldsymbol{x_2}) = [1 - \Phi(\boldsymbol{x_1}\boldsymbol{\gamma})]^{1(w=0)} \left[\Phi(\boldsymbol{x_1}\boldsymbol{\gamma})(2\pi)^{-\frac{1}{2}}\sigma^{-1}exp\{-(y - x_2^T\beta)^2/2\sigma^2\}/\Phi\left(\frac{x_2^T\beta}{\sigma}\right)\right]^{1(w=1)} \quad (5)$$

where w is a binary indicator equal to 1 if y is positive and 0 otherwise. The probability of $y > 0$ (and $y = 0$) is determined by the mechanism given in the vector $\boldsymbol{\gamma}$ and the value of y, given $y > 0$, is determined by a different mechanism given in vector $\boldsymbol{\beta}$. The estimates of $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are the Maximum Likelihood estimates of Cragg's likelihood function. Also, the vectors of covariates, $\boldsymbol{x_1}$ and $\boldsymbol{x_2}$ can be identical, but do not have to be identical. This means the decision to participate and the intensity of participation can be determined by a different set of covariates however, in the results presented in this paper, I use a set of identical $\boldsymbol{x_1}$ and $\boldsymbol{x_2}$ covariates.

In practice the Cragg model delivers two sets of estimates. One set of estimates is for the effect of variables contained in the set $\boldsymbol{x_1}$on the probability of reporting a positive amount of minutes, which will be denoted as the "participation" tier. The second set of estimates is for the effect of variables contained in the set $\boldsymbol{x_2}$ on the expected amount of minutes reported,

[7] The Stats package Craggit by Burke (2009), provides useful fitting of the Cragg's model and postestimation commands for marginal effects. Tobit and OLS results are available in the Appendix A Table A3 - Table A6 and discussed in the section for checks of robustness.

conditioned on having reported a positive amount, which is denoted as the "intensity" tier. The estimation method is the marginal effects from a Probit regression in the participation tier and after a truncated normal regression in the intensity tier.[8] [9]

Cragg's model assumes conditional independence, that is, the unobservable factors affecting participation decisions are uncorrelated with the unobservable factors affecting intensity decisions.

$$D(y|w, \boldsymbol{x}) = D(y|\boldsymbol{x}) \qquad (14)$$

Equation (14) expresses the assumption stating that conditional on a set of explanatory variables, the mechanisms determining w and y are independent (Humphreys 2013).

To model this data and understand the determinants of parents' time use and students' academic habits Cragg's two part model is estimated and are presented in the next section.

1.5 Results

For the first part of the analysis, I report results from the Cragg model using the sample of parents. The model is estimated separately for mothers and fathers to account for differences in gender regarding involvement in participation and intensity of children's activities. In the second part of the analysis, I report results from the Cragg model using the sample of students. The model is estimated separately for students' mother's and father's birth place by geographic region for differences in participation and intensity of school activities.

As a check of robustness, I also show results using three alternative estimation methods (Tobit, OLS regression and OLS regression on all non-zero observations), in order to show differences in results by popular estimation methods in time use research and by respondents who report a positive amount of minutes on the diary day. This check provides support for the use of a two-part model in estimating parental time use with children and for the magnitude and sign on the intensive margin.

[8] Postestimation results from Craggit, user-written estimation package by Burke 2009, produces same estimates as marginal effects from Probit and truncated normal regression.
[9] See Appendix A, A7 Craggit Marginal Effects for equations in computing marginal effects from Craggit model.

1.5.1 Parent Results

Table 1-4 shows the results for total care and Table 1-5 shows results for education time use categories. Results in the column labelled participation show the likelihood of investing time in education/total time and those in the columns labelled intensity show the effect of the covariate on the amount of minutes devoted to the activity, conditioned on the parent investing a positive amount of time. The narrative is limited to the variables of interest.

Fathers from South Central America spend significantly less time on total child care activity, around 36 less minutes than fathers born in Canada. Asian fathers are 8% more likely to participate in education activity with their children on the diary day and, given participation, I find both Asian mothers and Asian fathers devote more time at 27 and 22 more minutes per day respectively in comparison to their respective Canadian born counterparts.

European and African fathers are spending around 20 and 26 more minutes on educational activities with their children given participation on the diary day respectively compared to native-born Canadian fathers, but the result is only mildly significant. Mothers from South Central America are intensely spending around 18 more minutes on education activity with their children.

Educational time with parents seems to be a unique time use category offered in intense amounts of time or likely acts of participation by fathers born in Europe, Africa and Asia and mothers born in South Central America and Asia. Compared to total caregiving activity, the result found for spending more time or likely participation for these immigrant groups in education activity is not apparent in the time use category for total care that encompasses all care with their children. The results I find suggest that education activity, on average, is a dominant code of conduct among certain immigrant groups.

Table 1-4: Determinants of Total Child Care Minutes Per Day (SE)*.

	Mothers		Fathers	
	Participation	**Intensity**	**Participation**	**Intensity**
Africa	0.0172 (0.0557)	11.43 (15.75)	-0.0864 (0.0722)	-22.02 (13.67)
Asia	-0.0271 (0.0337)	25.81 (16.14)	-0.0490 (0.0479)	-6.667 (11.48)
Europe	-0.0607 (0.0376)	4.358 (14.97)	-0.00473 (0.0537)	7.192 (14.15)
SCA	-0.0257 (0.0425)	17.98 (17.50)	-0.0945 (0.0646)	-36.02* (18.10)
UKNA	-0.0271 (0.0429)	11.50 (17.57)	0.0894 (0.0608)	-19.34 (15.14)
Other	-0.0224 (0.0541)	37.79 (23.60)	0.00346 (0.0877)	15.83 (20.77)
Family structure	Yes	Yes	Yes	Yes
Human Capital	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	9,770	7,799	6,859	3,829

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

*Family Structure includes a binary variable indicating if the parent is a lone parent, if there are multiple generations in the household and if the youngest child of the household is less than four years old and a continuous variable for number of children in the household.

Human Capital includes respondent's age, education in levels, years since migration, years since migration squared and a binary variable to indicate if the respondent does not state their years since migration.

Table 1-5: Determinants of Education Minutes Per Day (SE)*.

	Mothers		Fathers	
	Participation	**Intensity**	**Participation**	**Intensity**
Africa	0.0627 (0.0590)	13.45 (10.08)	0.0563 (0.0503)	25.90* (10.47)
Asia	0.0634 (0.0427)	26.54*** (6.971)	0.0756* (0.0361)	21.85* (8.676)
Europe	0.0664 (0.0477)	8.253 (7.890)	0.0525 (0.0408)	20.30* (10.26)
SCA	0.00922 (0.0526)	17.57* (6.927)	0.0561 (0.0497)	19.05 (12.32)
UKNA	0.0647 (0.0497)	7.642 (8.898)	0.0484 (0.0445)	2.338 (11.34)
Other	0.164* (0.0697)	21.90 (14.09)	0.132* (0.0607)	13.13 (16.15)
Family structure	Yes	Yes	Yes	Yes
Human Capital	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes
Observations	9,770	7,799	6,859	3,829

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

*Family Structure includes a binary variable indicating if the parent is a lone parent, if there are multiple generations in the household and if the youngest child of the household is less than four years old and a continuous variable for number of children in the household.

Human Capital includes respondent's age, education in levels, years since migration, years since migration squared and a binary variable to indicate if the respondent does not state their years since migration.

1.5.2 Student Results

The second part of this analysis shows the results of the Cragg model estimated on a sample of respondents who state their major activity is going to school and are 15-25 years of age. As before, columns labelled participation show the results of likelihood for participating in the activity on the diary day and the columns labelled intensity show the results of the amount of minutes spent on the activity daily given a positive amount of minutes recorded on the diary day.

In this model I include a set of mother's birth place of origin controls and separately, I include a set of father's birth place of origin controls and show the results in separate panels in each table for the variable total school activity in Table 1-6 and homework activity in Table 1-7. I further expand the model by including an indicator for the student's gender. I use as covariates the same as those used to describe parent activities: age, work minutes on the diary day, and a set of survey year controls. I also include a binary variable indicating if the student has their parent present in the household to control for close proximity of parental influence to students' study behaviors.

Students with fathers and mothers born in the geographic region of Asia are both around 15% more likely to participate in homework and, given the students do participate in homework activity, they are spending around 48 and 43 more minutes on their homework respectively. These same students are not significantly participating in or intently investing more time in total school activity and taken with the result of homework activity for students with Asian parental background, this gives strength to the notion of home environment. Even though the students are not more likely to be involved in classes or special lectures, they are working on homework more often and for longer periods of time.

Students with European fathers and mothers are more likely to participate in homework activity than students with Canadian born fathers and mothers at around 13 and 10% respectively. However, the intensity of homework activity and the likelihood of participation and intensity of school activity are not significant.

Table 1-6: Determinants of Total School Minutes Per Day (SE).

	Students				
	Participation	**Intensity**		**Participation**	**Intensity**
m_Africa	-0.133 (0.0776)	-6.425 (29.10)	f_Africa	-0.123 (0.0801)	-7.856 (24.83)
m_Asia	-0.0113 (0.0334)	13.20 (10.15)	f_Asia	-0.0290 (0.0333)	9.671 (10.22)
m_Europe	0.0415 (0.0383)	-4.075 (8.579)	f_Europe	0.0229 (0.0348)	-9.333 (8.033)
m_SCA	-0.169* (0.0668)	7.630 (14.46)	f_SCA	-0.0568 (0.0689)	26.59 (25.72)
m_UKNA	-0.105 (0.0539)	-4.921 (22.91)	f_UKNA	-0.0201 (0.0549)	-26.81* (13.11)
m_Other	-0.0477 (0.0677)	-15.20 (22.19)	f_Other	0.00898 (0.0608)	-31.35 (20.91)
male	-0.0208 (0.0197)	-0.405 (5.106)	male	-0.0188 (0.0198)	-0.474 (5.147)
age	-0.0160*** (0.00419)	-5.464*** (1.404)	age	-0.0160*** (0.00420)	-5.601*** (1.402)
workhrs	-0.0302*** (0.00420)	-4.119* (1.684)	workhrs	-0.0301*** (0.00424)	-4.093* (1.685)
yr92	-0.0305 (0.0339)	-18.05* (7.466)	yr92	-0.0267 (0.0339)	-18.66* (7.453)
yr98	-0.0654 (0.0334)	-13.60 (8.890)	yr98	-0.0681* (0.0336)	-14.24 (8.811)
yr05	-0.00784 (0.0297)	8.497 (7.257)	yr05	-0.00694 (0.0299)	7.500 (7.318)
yr10	-0.0440 (0.0333)	9.576 (8.424)	yr10	-0.0430 (0.0336)	8.718 (8.464)
parentHH	-0.0218 (0.0293)	-3.358 (9.907)	parentHH	-0.0217 (0.0296)	-4.142 (9.974)
Observations	3,926	2,185	Observations	3,926	2,185

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1-7: Determinants of Education Minutes Per Day (SE).

	Students				
	Participation	**Intensity**		**Participation**	**Intensity**
m_UKNA	-0.0160 (0.0549)	23.61 (16.45)	f_UKNA	-0.00830 (0.0540)	19.83 (18.65)
m_SCA	-0.0474 (0.0704)	5.628 (30.94)	f_SCA	-0.0548 (0.0659)	-6.345 (39.57)
m_Europe	0.132*** (0.0379)	3.919 (13.90)	f_Europe	0.0964** (0.0356)	1.640 (12.04)
m_Africa	-0.0407 (0.0875)	66.83*** (19.95)	f_Africa	0.0690 (0.0809)	46.36* (19.89)
m_Asia	0.147*** (0.0338)	47.91*** (11.15)	f_Asia	0.138*** (0.0339)	43.28*** (11.53)
m_Other	0.0178 (0.0678)	-19.85 (26.87)	f_Other	-0.0103 (0.0591)	-3.332 (22.54)
male	-0.0659*** (0.0196)	-17.10* (8.016)	male	-0.0648*** (0.0196)	-17.50* (8.077)
age	0.0154*** (0.00431)	17.23*** (1.559)	age	0.0152*** (0.00433)	17.29*** (1.576)
workhrs	-0.0315*** (0.00454)	-8.772*** (1.935)	workhrs	-0.0319*** (0.00441)	-8.858*** (1.935)
yr92	-0.0333 (0.0333)	-10.38 (14.19)	yr92	-0.0310 (0.0333)	-11.19 (14.20)
yr98	-0.0320 (0.0332)	-21.28 (13.42)	yr98	-0.0335 (0.0331)	-20.71 (13.62)
yr05	-0.0342 (0.0295)	-24.84* (12.46)	yr05	-0.0353 (0.0295)	-23.49 (12.44)
yr10	-0.0443 (0.0332)	-29.09* (13.43)	yr10	-0.0476 (0.0333)	-27.68* (13.49)
parentHH	0.00872 (0.0292)	-1.111 (11.16)	parentHH	0.00873 (0.0294)	-1.073 (11.25)
Observations	3,926	2,163	Observations	3,926	2,163

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Students with African mothers and fathers are spending significantly more time on homework when they do participate in homework activity at around 67 and 46 more minutes respectively. Although, at the same time, this student group is not participating in school activity at a higher rate of participation or intensity.

Results for the parent and student samples support the findings in Corak (2008) that the parents of child immigrants are more "education inclined". The results I find provide context to this inclination as it is specific to certain immigrant groups. Furthermore, Corak (2008) shows that even for less-educated parents, immigrants seem to be able to pass on to their children values and behaviors that, in the context of the Canadian education system, encourage them to obtain higher levels of schooling, which is evidenced from the results of students' parental background and school and homework habits.

1.5.3 Check of Robustness: Alternate Estimation Methods

1.5.3.1 Parent Sample Alternate Methods

I show the results for the parent sample using alternative estimation methods (Tobit, OLS regression and OLS regression on all non-zero observations) to estimate the determinants of Total caregiving and Education activity with children in Appendix A, Table A3 – Table A4. The columns labelled "Tobit" are Tobit marginal effects, the columns labelled "Reg" are OLS regression coefficients and the columns labelled "Reg>0" are OLS regression coefficients using only nonzero observations of the dependent variable.[10]

Using alternative methods of estimation, I show that South Central American fathers are spending significantly less time on total child care activity is robust to the Tobit and regression model. South Central American women intensely spending more time on education related activities with their child is robust to the regression model. I find that Asian fathers are more likely to participate in and devote time to educational activities with

[10] Results estimated by OLS regression on nonzero observations are biased by construction, but I include these results here to exemplify that they produce different results from those estimated by truncated regression, which is the intensity tier.

their children is robust to the Tobit model. The intensity of education activity provided by Asian mothers is robust to all three alternative estimation methods.

1.5.3.2 Students Sample Alternate Methods

I show the results for the student sample using alternative estimation methods (Tobit, OLS regression and OLS regression on all non-zero observations) to estimate the determinants of "Total School" and "Homework" are in Appendix A, Table A5- Table A6. The columns labelled "Tobit" are Tobit marginal effects, the columns labelled "Reg" are OLS regression coefficients and the columns labelled "Reg>0" are OLS regression coefficients using only nonzero observations of the dependent variable.

The results for students with Asian parental heritage are robust across all model alternatives. The results for students with mothers from Europe are robust to the Tobit and OLS regression model and the result with fathers from Europe is robust to the Tobit model. The result that students with a mother from Africa intensely spend more time on homework activity given participation, is robust to the OLS regression model on nonzero observations.

1.6 Conclusion

The parent sample and the student sample results show that the decision to participate in different activities and the intensity of this participation are determined by two separate processes. Birth origin impacts the likelihood of participation for fathers born in the geographic region of Asia and impacts the intensity of time use for parents from Asia, Africa, Europe and South Central America are spending more minutes on education related activities with their children, given participation in this activity on the diary day, in times that range over approximately 17-27 more minutes per day than parents born in Canada. The likelihood and positive persistence of education activities perform by parents in these immigrant groups are not apparent in the performance of their total caregiving activities.

Taking both parts of the analysis together for the immigrant group of Asia, students with Asian parentage are more likely to do homework and do homework intensely than students with Canadian parentage while, at the same time, Asian parents are intensely investing more time on education activity inputs with respect to Canadian parents. Students

with European mothers and fathers are more likely to participate in homework activity and European fathers are spending more time on education activities with their children. When they do participate, students with African mother and father are spending more minutes on homework activity and African fathers are spending more minutes per day on education activities with their children. There is no significant result for students with parents from South Central America participating in or completing more homework and total school activities. South Central American mothers are significantly using more time inputs on education activity and fathers use less in total care with respect to Canadian born parents.

Educational time with parents seems to be a unique time use category offered in intense amounts of time or likely acts of participation compared to total caregiving activity. The results found for spending more time or likely participation for these immigrant groups in education activity is not apparent in the time use category for all childcare that encompasses all care with their children. The results I find suggest that education activity, on average, is a dominant code of conduct among certain immigrant groups.

Results for the parent and student samples support the findings in Corak (2008) that immigrant parents are more "education inclined". The results I find attempt to provide context to this inclination as it appears to be specific to certain immigrant groups in Canada. Furthermore, Corak (2008) shows that even for less-educated parents, immigrants seem to be able to pass on to their children values and behaviors that, in the context of the Canadian education system, encourage them to obtain higher levels of schooling. The results I present perhaps provide support of students' parental background and school and homework habits. The robustness checks in the set of covariates, sample restrictions and of the dependent variable outline goals to understand time use of Canadian immigrant families.

Policy perspectives on this topic include household well-being policies since "immigration policy is also family policy and the selection process also needs to recognize the independent role that family plays in promoting socio-economic progress" (Corak 2008). For the children of immigrants to succeed, immigration policy can benefit from analysis on the economic outcomes and parental inputs of immigrant groups since family can promote their progress. The results I find coincide with the recommendations of "targeted policies for

children's everyday life" (Phillips 2011) with an emphasis on reallocating children's time in favour of time spent in educational activities with parents (Fiorini & Keane 2014) to address the well-being of children in Canada.

Chapter 2 Household Income and Child Time in Canada

Allison Mascella and Ana Ferrer

2.1 Introduction

Time and money are the two main parental resources into child development considered by formal models within the fields of education and economics. The importance of economic resources in raising children is well known and has been established from many perspectives. However, the significance of parental time devoted to children or the trade-off parents face between allocating time to children or to the market in order to increase economic resources, although recognized by formal models, is harder to examine empirically due to lack of information regarding how families spend their time. In this paper we add to the literature on income-based measures and time-use in the family, to answer the demand for well-being measures beyond economic conditions (Alkire 2015), by capturing trade-offs in these characteristics using multidimensional poverty measurement methods. Specifically, we examine the relationship between parent's time with their children and gross equivalent income in Canadian households. Using time-diary data from the General Social survey (GSS) in 2010 and 2015, we calculate a two-dimensional poverty line based on household's income and time spent by parents in the presence of children to categorize Canadian children's needs along these dimensions. We find that generally, children in households identified as income-poor are not also in households considered time-poor. However, immigrant families are more likely than Canadian-born families to be in a poverty regime that cannot compensate income deficits with sufficiently high levels of child-time to become non-poor in a multidimensional sense.

Children's outcomes are strongly dependent on parental investment. In their seminal paper, Becker and Tomes (1979) formalized the transmission of earnings, wealth and consumption across generations. Many empirical papers since have found a positive association between family income and children outcomes (Levy and Duncan, 2000; Blau, 1999; Dahl and Lochner, 2012 among others). However, in many cases increases in family income originate from increased maternal labour supply and the substitution effect of this increase in household employment has been associated with less time spent with children and worse children outcomes. Baum (2003), Ruhm (2004), Hsin and Felfe (2014),

Carneiro et al. (2015) and Del Bono et al. (2016) all find evidence of such a negative association between parental work and child outcomes, suggesting an important trade-off between the two inputs in child development.

The rapid growth in income inequality documented in the US and Canada over the 1990s and 2000s raised a general concern about the dynamics of intergenerational mobility and the future well-being of children (Chetty et al., 2014).[11] Importantly, the rise in inequality extends to increasing divergence in hours of work. Phipps and Burton (2011) have documented significant differences in working hours associated to changes in income in Canada during this period. To the extent that the average minutes spent by parents with their children is lower for low income deciles, the two trends point to an increase in the fraction of children that will be raised without enough income resources *and* parental time.

Intergenerational mobility studies are also relevant in societies with large immigrant populations to help assess the extent of immigrant integration, which can take more than one generation to achieve. In general, family investments on children have a strong cultural component and one would expect that immigrant families may or may not mimic the parental investment strategies of otherwise similar native-born families. To the extent that immigration may select parents particularly focused on their children's successful integration as adults in the host country, one could expect more aggressive investment in child's development among these families. On the other hand, immigration is often costly and immigrant families may be particularly constrained in terms of resources – either time or income or both – to invest at similar rates as native-born families. Hence, highlighting the trade-offs between income and time might be particularly important for immigrant communities. Our study applies a unique measure to help quantify the extent to which Canadian families, immigrant or Canadian-born, are constrained in terms of child development inputs, with important implications for integration and mobility.

We use the General Social Survey (GSS) time-use cycles (2010 and 2015) to study the determinants of *time spent with children* (child-time) and household income and to develop a multidimensional poverty line with these two dimensions. We consider traditional approaches to measuring multidimensional poverty that do not allow for compensation between resources – the *union* or *intersection* approach – but also consider substitution between these two factors and estimate an interdependent multidimensional poverty line that allows for compensation. This *compensation*

[11] The growth of inequality in North America is well documented. See for instance, Atkinson et al. (2010) and Fortin et al. (2012) and references herein.

approach considers that households with sufficiently large amounts of one factor, may be considered non-poor even if they have below poverty line levels of the other factor (Merz and Rathjen 2014a, 2014b).

We find statistically significant differences in average household income between immigrant and native-born parents. In general, immigrant parents are earning significantly less income but are not spending significantly more total time on average with their children on a daily basis than native-born parents[12]. We estimate the likelihood of poverty incidence in a unidimensional sense and find that immigrant parents are more likely than Canadian-born parents to be poor in household income, but there is no significant association between immigrant status and poverty in child-time. We consider that the time parents spend with their children, which also impacts well-being, could be a compensating factor for low income and estimate an interdependent multidimensional poverty line using a multidimensional approach. We create a multidimensional poverty line along income and child time, that together with the unidimensional poverty lines for household income and child time, allows us to sort parents into one of six poverty regimes. We use these boundaries to estimate a Multinomial Logit model of the probability that a household belongs to each poverty regime. Using the compensation approach to poverty measurement, we show that *immigrants are more likely than Canadian born parents to be in a poverty regime where they are unable to substitute their deficit in household income with child time.*

Our estimates of household multidimensional poverty in child-time and household income identify families that are poor in either child-time minutes or household income, and those poor in both dimensions. We find that immigrant parents are more likely than Canadian born parents to be multidimensional poor in household income and child-time after allowing for compensation. This level of poverty incidence is less than that considering a unidimensional poverty incidence on household income alone, suggesting that low income immigrants do use child time to some extent as a compensating factor for deprivation in family income

The next section is a review of the literature related to household income and time in the production of well-being. Section 3 describes the method of estimating an interdependent multidimensional poverty line under the compensation approach. Section 4 summarizes GSS time-use data and the empirical methodology and section 5 reports descriptive results. Section 6 describes the

[12] In contrast to the results of chapter 1, which defined time-use variables of direct caregiving and educational activities performed by parents, chapter 2 defines a time-use variable as total time spent by parents in the presence of children.

results of the likelihood of multidimensional poverty and Section 7 concludes with a discussion of policy implications.

2.2 Literature Review

2.2.1 Multidimensional Well-being

In recent years a broader interpretation of well being has led to the development of new measures to inform social policy on the progress of a variety of aspects associated with well being that have been traditionally difficult to identify. These measures typically include non-economic dimensions, such as the value of relationships or time - in addition to income - as indicators for an analysis of well-being.[13] This broader approach to measuring well-being is a common practice in Canada and Europe. The Canadian Index of Wellbeing (CIW) 2012 Report uses eight quality of life domains, which includes a time use component to measure how people experience time and how time use affects wellbeing.[14] The index measures, for instance, care provided by the parent for their children showing that between 60-66% of parents spend time reading daily to their pre-school children and that this statistic has remained stable between 1994 and 2010. In France, the Commission on the Measurement of Economic Performance and Social Progress uses eight attributes of well-being, one of which is social connections and relationships, for analysis of well-being. The report advises to measure the quality of life with the notion of capabilities, which are a person's opportunities to do and be what they have reason to value and promotes the use of subjective dimensions of quality of life in domains such as the family (Stiglitz et al. 2009). Sweden and other Nordic countries have an approach to well-being analysis termed as the "Scandinavian approach to welfare". Since 1968 research programmes in Nordic countries use indicators that measure family and social integration as contact with friends and relatives (Aaberge and Brandolini 2014, Erikson 1989). Further, strategies in the Europe 2020 report suggest member states will need to facilitate the compromise of work and family life to achieve economic priorities (European Commission 2010).

[13] These new set of dimensions vary depending on the political climate and data availability (Aaberge and Brandolini, 2014; Alkire, 2011).

[14] There are eight quality of life domains tracked by the Canadian Index of well-being; education, living standards, community vitality, democratic engagement, healthy population, time use, leisure and culture and environment.

These examples illustrate how a broader perspective is being used to better measure and analyze well-being, and ultimately to become the focus of social policy. In this paper we focus on household income and the time parents spend with their children to broaden the perspective on the economic well-being of the family. Our analysis on multidimensional poverty suggests that poverty may be more or less intense when additional non-economic factors are considered.

2.2.2 Child Development in Canada

The social mobility of children can be defined as the extent to which a child's family background has an impact on their future successes as an adult. The relationship between parental inputs and the outcomes children experience as adults has long been recognized as important in the economics literature as well as in other disciplines. Becker and Tomes (1979) have a formal model for the importance of time and monetary resources as parental inputs with the result that increasing the parental provision of human and nonhuman capital for offspring, will rise children's income as adults. The literature on child development and child psychology provides support for the hypothesis that parents spending time with their children, maternal bonding and attentive parenting lead to optimal educational and social outcomes for children (Craig, 2007; Blesky, 2001).

Extensive empirical evidence on the time parents spend with their children finds positive affects on children's cognitive and non-cognitive skills. In the US, Cuhna and Heckman (2008) using data from Children of the National Longitudinal Survey of Youth (NLSY) 1979, find that parental inputs affect cognitive skills at early ages and non-cognitive skills at later ages. Carneiro and Rodrigues (2009) turn to time-use data from the US - available from the Child Development Supplement (CDS) of the Panel of Income Dynamics (PSID) in 1997 and 2002/03 – to conclude that more time with mothers leads both younger children (3-6 years old) and older children (7-12 years old) to perform better in cognitive tests. Del Bono et al. (2016) use the UK Millennium Cohort Study data set, measuring the time mothers spend with their children by the frequency of maternal time inputs of education and recreation activities, and finds that the more time spent on such activities, the higher are the cognitive and non-cognitive outcomes of children over ages 3-7 years.

The empirical evidence regarding the effect of income on child outcomes is mixed. Studies by Levy and Duncan (2000), Blau (1999), Dahl and Lochner (2012), among others, report a positive association, while studies by Baum (2003), Ruhm (2004), Hsin and Felfe (2014), Carneiro et al. (2015) and Del Bono et al. (2016) report a negative association. Economic theory suggests that household income and children's future well-being as adults involves the opposing forces of higher income and

less time. Increases in household income often occur from increases in maternal labour supply (income effect) and, at the same time, increases in the maternal labour supply decreases the amount of time available for children (substitution effect). A recent paper by Agostinelli and Sorrenti (2018) uses an instrumental variable (IV) analysis for the causal effect of household income and maternal labour supply on cognitive and behavioural outcomes of children. Those IV results find that an additional $1,000 in family income improves cognitive development by 4.4 percent of a standard deviation but has no effect on behavioural development whereas an increase of 100 hours per year in maternal labour supply decreases cognitive development and behavioural development by approximately 6 and 5 percent of a standard deviation respectively. This means that the positive income effect (on cognitive development) is counterbalanced by a negative substitution effect (on cognitive and behavioural development). Furthermore, the authors find that at an after-tax hourly wage rate below $13.50, the choice for higher earnings (income effect) is not enough to compensate for the loss in children's outcomes induced by mothers working more hours (substitution). That is, at low wages parents' work hours are not adding to children's outcomes because the increase in household income does not cover the loss in maternal time spent with children. In addition, the authors use regressions of income and hours worked on child-care time-use categories from the American Time Use Survey combined with the American Heritage Time Use Survey and find that maternal hours worked are negatively associated with parental time investment and higher family income does not correlate with parental time investment.

In a descriptive study, Altintas, Casarico and Sommacal (2016) use the Multinational Time Use Study (MTUS), consisting of a sample of 20 countries (including Canada) from 1994-2011, to create a sample of married or cohabitating parents with child(ren) under the age of 5. The study focuses on the distribution of primary care provided to children and calculates the Gini coefficient of parental time-use and its correlation to various measures of income. They find a rightward shift in the distribution of primary care to children, which means that the share of parents devoting a sizable amount of time to their children has increased. However, at the same time, they find that inequality in primary care among parents with low levels of education is higher than that among parents that have a high level of education, which provides evidence of dispersion in the care provided by parents for their children by socioeconomic characteristics despite an increase in the average. Furthermore, the authors find a positive and significant correlation between the Gini index for primary care and for disposable income as well as with the income poverty rate. The implications of these findings are that societies with a greater dispersion in the care that children receive at home also experience greater relative deprivation

in household finances. In terms of children's future outcomes as adults, Altintas et al (2016) term the lower-end of the distribution in both resources as a risky home environment. This heterogeneity in time-use by socioeconomic characteristics and positive and significant correlation with income provides motivation for our analysis.

Only few studies account for time-use with children in addition to household income as a component of well-being of Canadian families. The economic well-being of Canadian children from the 1970s to 2006 is measured indirectly, in terms of time, in Burton and Phipps (2011). Their research finds that families with children in the lower deciles of the income distribution saw an increase in the number of hours parents work, which would make the children more vulnerable to experiencing a shortage in time resources. Further, recent research by Burton and Phipps (2017) suggests that families with children in lower income deciles did not experience increases in equivalent government transfers while families with children in top income deciles experienced an increase. Taken together the results suggest that it is unlikely there has been a compensating income transfer to atone for increasing time deprivation. This analysis suggests that inequality and low income continue to be a concern among Canadian families with children.

Further to our analysis, research shows that the strength and direction of the relationship between children's outcomes and family background can differ based on demographic and economic characteristics of the child's family. Cultural background is an important determinant of household choices, affecting the allocation of time and resources. Hence, countries with large immigrant populations, such as Canada, are likely to show differences in parental resources invested in children along cultural groups (Bleakley and Chin, 2010). Further, immigrants are also likely to be more resource constrained than the Canadian born. In particular, recent immigrants to Canada are more likely to experience low-income (Lu and Picot, 2017) and earn less than similar native-born Canadians (Aydemir and Skuterud, 2005). Given these trends in immigrant family income and poverty incidence, there is an obvious concern regarding the social mobility of second-generation immigrant children. Aydemir, Chen and Corack (2009) find that there are constraints on social mobility among the immigrant population and that parental education is important in overcoming such barriers. Furthermore, the authors find that children's human capital production process varies by parental birth place, leading to differing social mobility and labour market outcomes.

Research into parental time-use seems to support the idea that children from households at the lower end of the income distribution may experience not only less material resources, but also less time with their parents. Further, immigrant families seem to be particularly vulnerable to income constraints

that could be compounded by a reduction in time spent with children. We attempt to better measure child poverty with a multidimensional approach to better understand the inequality of opportunity that might impact the social mobility of Canadian children. If parents that are poor in income can substitute their income deficiencies with time spent with their children, then the multidimensional approach of measuring both household income and child time could redefine the poverty status of this sub-group. By taking both time and income into account in the development of our poverty line, our analysis further emphasizes the poverty position of Canadian children, identifying families that are unable to compensate with income the lack of time spent with children.

Time-use as a dimension of well-being has been studied in Merz and Rathjen (2014a, 2014b) using personal leisure time in addition to household income to address multidimensional poverty in Germany. The authors use time-use diary data to include leisure time as an input in the utility function and estimate the likelihood of poverty in a multidimensional sense, commenting on the ability to substitute leisure time for income deficiencies to become non-poor. Our study uses a similar methodology, but rather than focus on the work-life balance of adults, we consider the family-life balance of parents and the ability of parents to substitute income deficiencies with time spent with their children to become non-poor in a multidimensional sense.

2.2.3 Poverty Measures Along Time and Income

There are multivariate methods available to include non-monetary factors alongside household income in poverty measurement. Maasoumi and Lugo (2009) and Bourguignon and Chakravarty (2003) use an axiomatic approach to define multidimensional poverty indices, which quantifies the overall magnitude of poverty by a real number. The indices combine poverty gaps in each resource and, dependent on parameter choice, define individuals as multidimensional poor for being deprived in one, both or allow for compensation between resources to become non-poor. Both papers provide an illustration of a mixture of income and non-income resources to compute the indices measuring poverty under alternate definitions.[15]

Unidimensional poverty lines can be set using the concept of the relative or absolute approach. Relative poverty is measured by setting the level of achievement by a household or individual in a specific dimension in comparison to a modal value, which represents a social norm such as the median

[15] Maasoumi and Lugo (2009) use real per capita expenditure, level of hemoglobin and year of education achieved by the head of the household in Indonesia and Bourguignon and Chakravarty (2003) use income and education level in rural Brazil.

income in a given community (Desai and Shah, 1988). Poverty in an absolute sense is described by a given level below which individuals or households are poor, such as minimum nutrition levels for subsistence (Callan et al. 2009). The current literature is not conclusive on a minimum amount of time that parents should spend with their children daily, which suggests that the relative approach is more adequate in this case. Further, income poverty is often measured in relative terms as well to better include considerations of economic development when measuring poverty over time.

In addition to the unidimensional poverty line, we estimate a multidimensional line using the compensation approach and compute the likelihood of multidimensional poverty incidence as in Merz and Rathjen (2014a, 2014b). In the compensation approach, the multidimensional poverty line is derived from a CES utility function, which we define over time and income. Modelling interdependence between dimensions in this manner accounts for the economic substitutability between time with children and earned income. Empirical estimation of the parameters of a non-linear utility function, such as CES, requires the use of either non-linear estimation techniques, or a translog approximation method such as, Kmenta (1967). The Kmenta approximation is based on Taylor series expansions around the elasticity of substitution equal to one. Thus, one caveat to using the Kmenta's linear approximation is that the linearization is only applicable for elasticities of substitution close to one or the curvature parameter is equal to zero. Further, since the translog form is a truncated Taylor series, the parameters might be biased by a truncation error. There are three criteria, described below, on the acceptable values of the parameters and the inputs. When the criteria are not met, the exact form of the CES function must be used and estimated with non-linear techniques (Hoff, 2004). We combine the multidimensional poverty line, with two unidimensional poverty lines (for household income and child-time) to define six poverty regimes and estimate the likelihood of parents being in each regime.

2.3 Methods

To evaluate the set of poverty dimensions, we define and estimate an interdependent multidimensional poverty line using the Kmenta (1967) approximation method as in Merz and Rathjen (2014a, 2014b). The multidimensional poverty line will be derived from a CES utility function reflecting the trade-off between income and time. Hence the poverty line is defined allowing for compensation between below poverty threshold levels of consumption in one factor and above poverty threshold levels of consumption in the other factor. We consider household income and the time parents spend with their children as the factors in our CES utility function.

The CES-utility function of a parent's personal life satisfaction (u) on household income (I) and time spent with their children (T) is:

$$u = f(I,T) = \gamma.(\delta.I^{-\rho} + (1-\delta).T^{-\rho})^{-\frac{\nu}{\rho}} \quad (1)$$

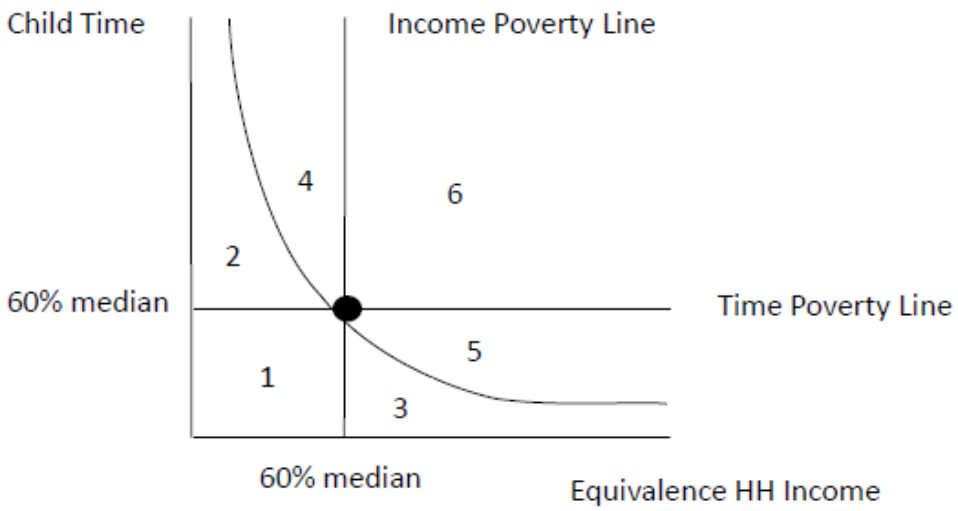
with substitution elasticity between income and child time, $\sigma = \frac{1}{1+\rho}$, ρ as the curvature parameter, γ is a constant, ν is the return to scale and δ the weight each factor has on utility.

The compensation approach recognizes that an individual can be consider non-poor in a multidimensional sense if the level of one input can compensate for the depth of deprivation of the other. Figure 2-1 shows graphically the differences in the scope of poverty definitions under the multidimensional approach and the unidimensional poverty lines calculated at 60% of the median of each input. The curve depicts the indifference curve of the CES utility function (equation 1) and is termed an isopoverty curve as it incorporates the trade off between the two inputs in child raising while maintaining a specific level of utility. Hence, the curve represents combinations of household income and child time that are equally acceptable for a household with resources at the poverty threshold. Points below the curve correspond to households that are multidimensionally poor and points above the curve correspond to households that are not multidimensionally poor by the compensation approach. Multidimensional poverty arises not only because the household has below-threshold resources in both inputs, but also for households that posses abundance of one resource, but not enough to compensate for low levels of the other resource, such as those depicted in areas 2 and 3. Conversely, a household is non-multidimensional poor in area 4 and 5 due to compensation.

The compensation approach contrasts with other approaches to multidimensional poverty, such as the *union approach*, which classifies an individual as multidimensionally poor if the individual is below poverty level consumption in at least one dimension, or the *intersection approach*, which classifies an individual as multidimensionally poor if the individual is below poverty level consumption in both dimensions. The union approach considers each dimension equally critical to well-being, resulting in a more conservative definition of poverty than the intersection indicator. The intersection approach delivers a narrower definition of poverty since parents are multidimensionally poor only if they fall below the threshold in both dimensions. Finally, the compensation approach falls between these two approaches as parents can compensate the lack of one input in children's uprising with above

poverty threshold amounts of the other. Being multidimensionally poor under the compensation approach, corresponds to the area below the curve in Figure 2-1 (zones 1, 2, and 3). Being multidimensionally poor under the union approach, corresponds to the areas 1, 2, 3, 4 and 5 in Figure 2-1. Finally, being multidimensionally poor in both dimensions corresponds to section 1 in Figure 2-1 under the intersection approach.

Figure 2-1: Multidimensional Poverty Line with Compensation and Poverty Regimes.



A novel contribution in Merz and Rathjen (2014a and 2014b) is the estimation of the parameters of the CES-utility function, necessary to compute the multidimensional poverty line with compensation, using the Kmenta (1967) linear approximation method.[16] Kmenta (1967) used a translog version of the CES-utility function which employs the first and second order terms in the Taylor series to linearize the equation to be estimated, assuming a substitution elasticity equal to unity (curvature parameter equal to zero) as in equation (2):

$$\ln u = \ln \gamma + \nu\delta lnI + \nu(1-\delta)lnT - \frac{1}{2}\rho\nu\delta(1-\delta)[lnI - lnT]^2 + \varepsilon \qquad (2)$$

[16] Past analysis of a CES-utility function as the multidimensional poverty line, Bourguignon and Chakravarty (1999) and (2003) and Lugo and Maasoumi (2009), requires the researcher to choose starting values for the parameters prior to estimation and presents possible convergence problems.

where ε is an i.i.d distributed error term. Renaming the parameters of the model, we have the following regression:

$$\ln u = \alpha_0 + \alpha_1 lnI + \alpha_2 lnT + \alpha_3 [lnI - lnT]^2 + \varepsilon \qquad (3)$$

We estimate equation (3) using Ordinary Least Square (OLS) with a measure of utility, such as the log of a parent's personal life satisfaction, as the dependent variable, the log of household income, the log of a parent's time spent with children, and the squared difference of the log of income and the log of time for the Kmenta correction factor, $\frac{1}{2}\rho v\delta(1-\delta)[lnI - lnT]^2$ as the regressors. [17]Then we use the estimates of the coefficients α_0, α_1, α_2 and α_3, to recover the structural parameters of the model using equations (4) to (7) and to calculate the elasticity of substitution using equation (8);

$$\gamma = e^{\alpha_0} \qquad (4)$$

$$v = \alpha_1 + \alpha_2 \qquad (5)$$

$$\delta = \frac{\alpha_1}{\alpha_1 + \alpha_2} \qquad (6)$$

$$\rho = (-2)\frac{\alpha_3}{\alpha_1 - \frac{\alpha_1^2}{\alpha_1 + \alpha_2}} \qquad (7)$$

$$\sigma = \frac{1}{1+\rho} \qquad (8)$$

Since the translog form is a truncated Taylor series, the parameters might be biased by a truncation error. There are three criteria to be used as guidelines to ensure the mathematical applicability of the approximation method. These criteria are (1) the curvature parameter, ρ, should not exceed +0.1 to +0.2; (2) the returns to scale, v, should be less than unity and (3) the logarithm of the ratio of the inputs, $ln\left(\frac{I}{T}\right)$, should be less than $ln\left(\frac{1}{\rho\sigma}\right)$ (Hoff 2004).

[17] Equation (2) is an approximation of the CES production function and the correction factor represents a correction in the departure from the curvature parameter, ρ (Kmenta, 1967).

The final step in the computation of the multidimensional poverty line with compensation is to use the chosen levels of poverty in household income, I_{poor}, and in time spent with children, T_{poor} as well as the parameters in equations (4)-(7) to obtain the isopoverty line:

$$u_{poor} = f\left(I_{poor}, T_{poor}\right) = \hat{\gamma}.\left(\hat{\delta}.\ {I_{poor}}^{-\hat{\rho}} + \left(1-\hat{\delta}\right).{T_{poor}}^{-\hat{\rho}}\right)^{-\frac{\hat{\nu}}{\hat{\rho}}} \qquad (9)$$

Then, one can identify parents that are multidimensionally poor under the compensation approach, as those whose utility is below the poverty threshold utility. That is,

$$u_i = f\left(I_i, I_i\right) = \hat{\gamma}.\left(\hat{\delta}.{I_i}^{-\hat{\rho}} + \left(1-\hat{\delta}\right).{T_i}^{-\hat{\rho}}\right)^{-\frac{\hat{\nu}}{\hat{\rho}}} \quad < u_{poor} \quad (10)$$

The estimated multidimensional poverty line and the two unidimensional poverty thresholds define a set of 6 mutually exclusive poverty regimes (See Figure 2-1). Parents are multidimensionally poor under the compensation approach if they are below the multidimensional poverty line (poverty regimes 1, 2 or 3) and not poor if they are in poverty regimes 4, 5 or 6. Poverty regime 1 defines the core of multidimensional poverty, those individuals who are simultaneously poor in both dimensions, whereas poverty regime 6 defines non-poverty in both dimensions. Poverty regime 2 defines those who are income poor and cannot compensate their income deficit with above poverty threshold levels of time, so remain multidimensional poor, while poverty regime 4 defines those that can compensate their income deficits with above time-poverty levels to become non-poor in a multidimensional sense. Time-poor parents are in regimes 3 and 5, but parents in regime 3 cannot substitute their time poverty with above poverty threshold levels of household income, so remain multidimensional poor, while parents in regime 5 can make that substitution and are non-poor in a multidimensional sense. From this set of 6 mutually exclusive poverty regimes, we define two categorical dependent variables – one taking on the value 1 and 0, depending on utility below the poverty threshold in (9) and one taking values 1 to 6, depending on the poverty regime the household belongs to. Finally, a Probit model is used to estimate the likelihood that a household is multidimensional poor and a multinomial logit model is used to estimate the likelihood that a household belongs to one of six poverty regimes based on parental immigrant status and other characteristics of the parent and family.

2.4 Data

The data used here comes from the General Social Survey (GSS) time-use cycles 2010 and 2015. The time-use cycles of the GSS collect a time diary in addition to personal and household characteristics. GSS 2010 and 2015 are the only GSS cycle years with a continuous variable for household income as well as a variable for respondent's personal life satisfaction needed for this analysis. The time diaries list the minutes and social contact(s) for each activity reported by the respondent on the diary day. Social contact(s) at the time of performing an activity indicates if there is a family member or friend in the presence of the respondent at the time of performing each activity. *Children aged 14 years or younger that live in the respondent's household* is a category of social contact for family members. The records are for one 24-hour period collected from one respondent per household over the age of 15 years.

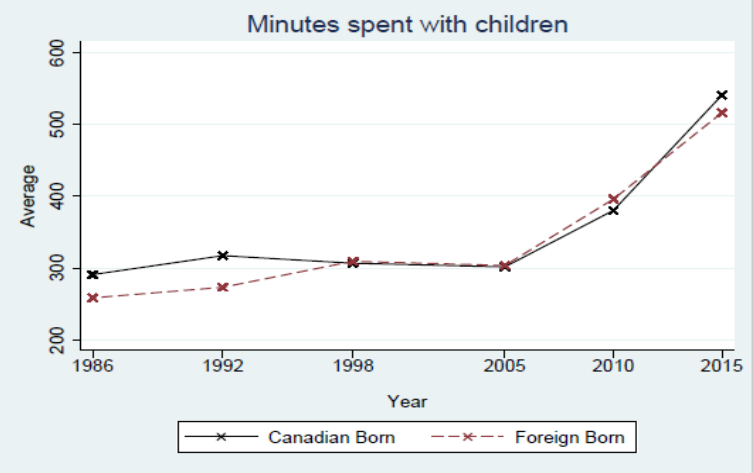
The time-use cycles of the GSS collects information on time spent in social contact with children, a unique feature of the data that offers new insight into the formation of social capital. Our measure of child-time includes the respondent's total number of minutes spent in direct primary care, like reading a story, or dressing a child, and in indirect secondary care, like going shopping with or completing household chores alongside their child. Hence, child-time is an inclusive measure which captures forms of human capital - like learning behavioral and social cues - responsible for social cohesion, and of maternal bonding and attentive parenting, which are considered to influence the long run outcomes of children ((Coleman, 1988; Craig, 2007; Blesky, 2001). This influence of time-use on long run outcomes of children is corroborated by empirical evidence suggesting that parental time spent in the company of children affects children's outcome on cognitive and non-cognitive test scores (Cuhna and Heckman, 2008; Carneiro and Rodrigues, 2009; Del Bono et al., 2016). To the best of our knowledge, this paper is the first time that the analysis of time use focuses on the relative deprivation in total time parents spend with their children in addition to deprivation in household income.[18]

Figure 2-2 and Table 2-1 show an upward trend in average time spent by parents in the presence of their children by immigration status. Previous research has shown that the average amount of time parents spend performing childcare duties for their children has increased (Zuzanek, 2001; Sayer, et al., 2004; Altintas, 2016; Altintas et al., 2016). The figure shows that there are differences in the

[18] Wray (2020) uses total time spent in the presence of children from GSS cycles 2005 and 2010 to measure the accessibility of fathers for their children after parental leave policy reform in Quebec.

increase in time spent with children across the two groups. Immigrant parents are spending, on average, approximately *twenty minutes less* of child-time compared to native-born Canadian parents in 1986. After 1998, the two groups showed similar time spent in the presence of children. After the significant increase experienced in 2010 by the two groups, there is no noticeable trend. In 2010 immigrants are spending approximately *16 minutes more*, whereas in 2015 immigrant parents are spending approximately *25 minutes less* with their children compared to Canadian-born parents.

Figure 2-2: Average Child-time Minutes per Day by Place of Birth and Year 1986 – 2015+.



[+]Sample: Parents with at least one child age <=14 years.

Table 2-1: Average Child-time Minutes per Day by Place of Birth and Year 1986 – 2015 (SE).

	1986	1992	1998	2005	2010	2015
Canadian Born n=16,297	291.04 (6.02) n=2,747	317.41 (5.83) n=2,526	306.83 (6.02) n=2,456	301.06 (4.97) n=3,649	380.44 (6.54) n=2,603	540.82 (10.65) n=2,318
Foreign Born n=3,571	258.68 (11.50) n=452	273.42 (14.47) n=423	309.53 (12.92) n=437	303.73 (9.56) n=809	396.07 (13.06) n=679	516.31 (18.25) n=771

[+]Sample: Parents with at least one child age <=14 years.

During the same time period we consider, Lu and Picot (2017) find that Canadian immigrants aged 25 years or older exhibit higher rates of low income than native-born Canadians.[19] In the 2010 and 2015 GSS time-use cycles, household income is a continuous variable, defined as self-reported total household income received by all household members from all sources before taxes and deductions.[20] We divide household income by the square root of the household size to adjust for family size.

Table 2-2 shows summary statistics for child-time and household income by immigrant status using GSS 2010 and 2015. We restrict the sample to parents with their youngest child living in the household aged 14 years or less, with a valid household income response and outliers of household income removed. On average, immigrants are spending around 2 minutes/day less in the presence of their children and reporting around 8,200 dollars less in household income per year. A test of the hypothesis that the means between the two groups are equal is rejected for household income, but not for child time. The result of the two-group hypothesis test suggests that immigrant parents have on average significantly less household income but that there is not a significant difference in time spent with children.

Table 2-2: Average Child-time Minutes per Day and Household Income by Place of Birth 2010 – 2015 (SE).+

	Foreign Born	Canadian Born
Child-time Z = 0.13 Pvalue = 0.898	462.55 (12.79)	464.41 (6.91)
Household Income Z = 6.18 Pvalue = 0.00	46,063 (1,150)	54,274 (667)
Observations	1,235	4,265

+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.

[19] Empirical evidence documents immigrants in Canada exhibiting higher rates of low income prior to 2010 (Picot and Sweetman 2004, Aydemir & Skuterud 2005).

[20] Household before-tax income is available as a categorical variable in GSS time-use cycles 1986 – 2015 and as a continuous variable in 1986, 2010 and 2015.

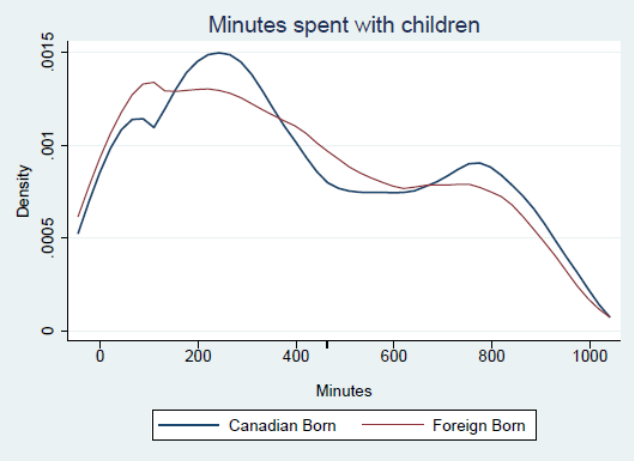
To characterize the distribution for child-time Figures 2-3 and 2-4 show estimates of the density and cumulative distributive functions by immigrant status.[21] In Figure 2-3, the distribution of child-time for native-born parents looks bimodal with a peak around the 250 minutes and a second – less pronounced – peak below the 800 minutes mark. The immigrant parental time distribution has a lower peak at the 100 mark and a much less pronounced secondary peak at higher levels of the distribution. At the mean, the distribution function is denser for foreign-born parents than for Canadian born parents. There is a higher proportion of Canadian born that spend between 200 and 300 minutes, but a lower proportion of Canadian born that spend between 400 and 600 minutes. The CDF for child-time (Figure 2-4) crosses multiple times so there is no clear ordering between these two distributions.

Figures 2-5 and 2-6 show the density and cumulative distributive functions for household income by immigrant status.[22] The PDF and CDF for immigrants is to the left of that for native-born parents, so the distributions indicate lower household income for immigrant parents than Canadian born parents. More foreign-born parents are represented at the bottom of the income distribution. For instance, at the bottom of the distribution, approximately 25% of foreign-born parents have less than CAD$ 25,000 versus approximately 10% of native-born parents.

Table 2-3 shows summary statistics for the main variables in the model by immigrant status. Immigrant parents are on average older and have a higher level of education compared to native-born parents (bachelor degree and graduate degree). The table also shows other plausible determinants of time spent with children. For instance, if primary and secondary care of younger children is considered a duty of the female parent, differences in the proportion of male parents in the sample by immigrant status could be behind differences in the amount of time immigrants and native-born parents spend with their children. However, the sample has approximately the same proportion of males among immigrant and Canadian-born parents (0.506 and 0.478). Therefore, it is unlikely that differences in the proportion of males in the sample are responsible for differences in time spent with children. Another plausible variable that differs between the two groups is the fraction of lone parents (10% and 9% of native-born and immigrant parents respectively). This could influence the amount of time feasible for parents to spend in the presence of their children in a positive or negative way. Having no other parental figure in the household to delegate childcare duty, a parent might spend more time with their child(ren), whereas being a sole financial provider and working more hours, a parent could have less child-time.

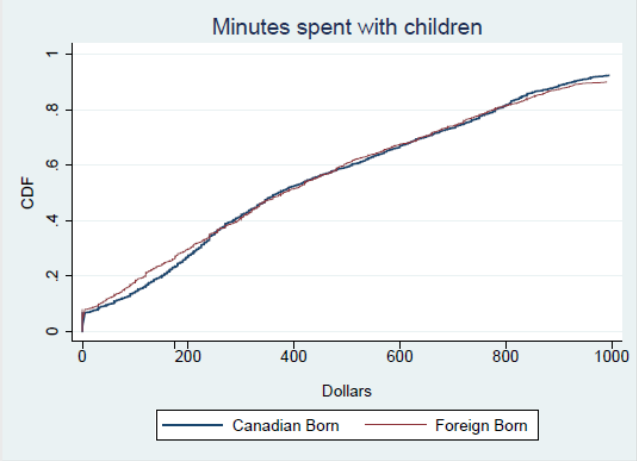
[21] Respondents with zero minutes reported for child-time is 6.89% (379/5500).
[22] Respondents included in the sample with zero dollars reported for household income is 0.12% (7/5500).

Figure 2-3: Density Plot for Child-time Minutes Per Day by Place of Birth 2010 – 2015.+*



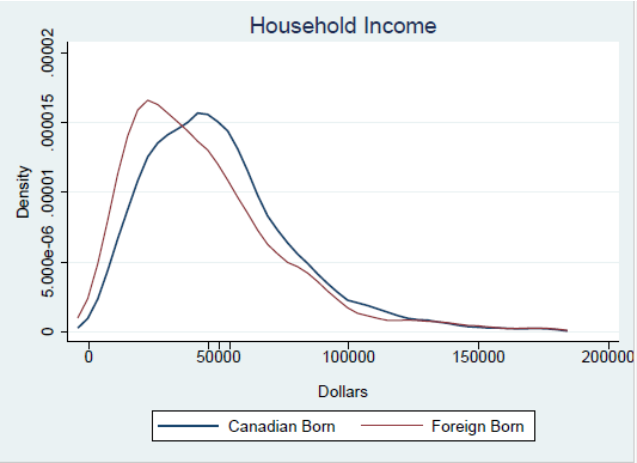
+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.
*For observations below 1000 minutes as per Research Data Center confidential vetting rules on PDFs as too few respondents reported a number of child-time minutes greater than 1000 minutes per day.

Figure 2-4: CDF for Child-time Minutes Per Day by Place of Birth 2010 – 2015.+*



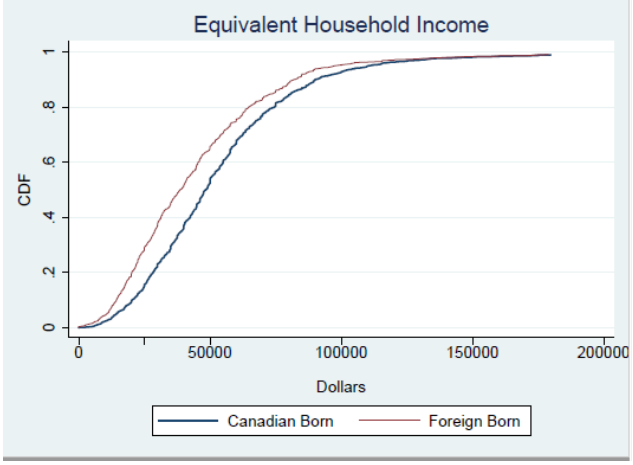
+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.
*For observations below 1000 minutes as per Research Data Center confidential vetting rules on CDFs as too few respondents reported a number of child-time minutes greater than 1000 minutes per day.

Figure 2-5: Density Plot for Household Income per Year by Place of Birth 2010 – 2015. +*



[+]Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.
[*]For observations below 180,000 dollars as per Research Data Center confidential vetting rules on PDFs as too few respondents reported an income of greater than 180,000 dollars per year.

Figure 2-6: CDF for Household Income per Year by Place of Birth 2010 – 2015. +*



[+]Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.
[*]For observations below 180,000 dollars as per Research Data Center confidential vetting rules on CDFs as too few respondents reported an income of greater than 180,000 dollars per year.

However, we find that lone-parent status is only slightly more prevalent at 1% for native born parents so it is unlikely that relationship status by place of birth is responsible for differences in the time spent with children. The differences between the two groups in terms of other determinants of time that can be devoted to children, such as the average household size, work hours, number and age of the youngest child in the house, is negligible. Finally, more foreign-born parents live in a CMA, as it is well established in the literature.

Finally, in estimating the interdependent multidimensional poverty line that allows for compensation, we require a measure of an individual's utility. We use the answers to the following question - available in GSS 2010 and 2015 - to create the variable, *life satisfaction "On a scale of 1 to 10 where 1 means 'Very dissatisfied' and 10 means "Very satisfied", how do you feel about your life as a whole right now?"*.

Table 2-3: Summary Statistics by Place of Birth 2010 – 2015 (SE).+

	Foreign Born	**Canadian Born**		**Foreign Born**	**Canadian Born**
YSM	15.73 (.37)	n/a	Male	.506 (.02)	.478 (.01)
Less HS	.059 (.01)	.084 (.01)	Work Hours	4.26 (.15)	4.37 (.09)
HS	.159 (.01)	.193 (.01)	Lone Parents	.093 (.01)	.105 (.01)
College	.297 (.02)	.394 (.30)	Number of Children	1.80 (.03)	1.89 (.02)
Bachelor	.267 (.02)	.153 (.01)	Age of Youngest	6.25 (.16)	5.93 (.09)
Grad	.220 (.01)	.176 (.01)	Multiple Generations	.085 (.01)	.034 (.01)
Age	40.61 (.25)	37.93 (.14)	Household Size	4.24 (.05)	4.03 (.02)
Observations	1,235	4,265	Observations	1,235	4,265

2.5 Descriptive Results

We first use a simple OLS model to explore the determinants of child-time and household income. The estimated coefficients of the regressors (parent's immigrant status, human capital characteristics and characteristics of the household) are presented in Table 2-4.

The coefficient for immigrant is not significant in the regression of child-time, but it is highly significant at – $29,290 less than Canadian born parents – in the regression for household income. Note, however, that household income significantly increases for immigrants with years since migration. The association with child-time is also positive for years since migration but is not statistically significant.

Gender and work hours are significant determinants of child-time. The coefficient on gender describes the feminization of time spent in the presence of children with fathers spending around an hour and twenty-five minutes less average daily minutes than mothers. The coefficient for gender does not have an obvious interpretation in the household income regression, as it only indicates that the respondent to the time-use survey is a male. A male respondent is associated with higher household income, but the result is not statistically significant. In addition, respondent's hours of work are highly significant and positively associated with household income and negatively related to child-time. One extra hour of work increases family income by $440 and decreases time spent in the presence of children by around half an hour.

Parents with any level of education spend more time with their children than the reference group (parents whose highest education is a college diploma), but somewhat surprisingly, the differences are not statistically significant. Education levels are, however, highly significant, and strongly associated with household income. The coefficients on education levels have the expected sign, with higher levels of education being significantly associated with greater household income. For instance, parents with a bachelor's degree live in households reporting incomes that are $15,641 higher and parents with a high school diploma live in households reporting income that are $5,554 lower than in households where the reported education is a college diploma.

As the age of the youngest child increases, the amount of time parents spend in the presence of their children decreases significantly by approximately 15 minutes. This result follows from the inclusion of both primary and secondary care in the computation of child-time, since older children do not require as much parental supervision at older ages compared to younger ages. This variable does not affect household income. Multiple generations present in the household allows parents around one hour and 17 minutes less child-time and an additional $4,717 in household income, but this result is only mildly significant for child-time and insignificant for household income. Finally, there is no

Table 2-4: Determinants of OLS Regression (SE).+

	Child-time	Household Income
Immigrant	-52.50 (26.85)	-29,290.60*** (2658.10)
Years since migration (ysm)	3.66 (2.98)	945.00*** (286.80)
ysm^2	-0.04 (0.07)	-6.33 (6.46)
Not stated ysm	-141.00 (149.30)	21,151.80 (21796.50)
Less than HS	9.09 (21.52)	-6,246.50** (1903.60)
High School	16.00 (15.09)	-5,554.20*** (1142.30)
Bachelor	1.10 (14.11)	15,641.70*** (1855.10)
Grad	0.48 (12.84)	15,499.10*** (1696.30)
Age	-1.60 (0.93)	560.90*** (97.56)
Male	-84.07*** (10.81)	1,368.40 (1158.40)
Work hours	-36.88*** (1.10)	439.50*** (121.00)
Lone parent	-24.88 (16.10)	-19,565.00*** (1235.10)
Multiple generations	-76.53* (31.82)	4,716.90 (2935.00)
Number of children	10.75 (6.01)	-4,025.70*** (559.70)
Age youngest child	-15.81*** (1.50)	-119.30 (167.60)
Yr15	160.10*** (9.81)	3,817.20*** (1145.70)
CMA	19.97 (11.10)	7,580.60*** (1094.30)
Constant	702.90*** (33.24)	32,691.30*** (3378.10)
Province	Yes	Yes
Observations	5,500	5,500

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.

significant result for other determinants of time, such as being a lone parent and the number of children. Note, however, that being a lone parent has a strong negative conditional correlation with household income (lone parent's household income being $19,565 lower than in other households) and that as the number of children increases, household income decreases by around $4,026 per year.

In summary, after controlling for a variety of human capital and household characteristics, it appears that immigrants' household income is certainly less than that of the native born, but they do not spend a significantly lower amount of time with their children.

The OLS results consider the influence of the explanatory variables on the average child-time and household income. However, besides the average, we are specifically interested in understanding what factors influence the incidence of poverty in either of the two dimensions considered here, child-time or household income. To this effect, Table 2-5 shows the marginal effects of human capital and household characteristics that can be related to the incidence of poverty, estimated with a Probit model. The poverty line is set at 60% of the weighted median – 175 minutes in child-time and $25,000 in household income.

Results for the incidence of poverty mimic those obtained for the OLS estimates. Immigrant parents are 26.8% more likely to be poor in income and 3.32% more likely to be poor in child-time than native-born parents, however, the later result is not significant. Education levels predict the likelihood of income poverty in the expected way - parents with low education (less than college degree) are 11.6% and 6.0% more likely to be below the poverty line - whereas those with higher education are 4.3% and 6.1% less likely to be income poor. Somewhat surprisingly, education does not significantly predict time spent with children. Increasing the amount of time devoted to work increases the likelihood of being poor in child time and reduces the incidence of low income. One extra hour of work is associated with a 2.48% likelihood of being below the poverty line in child-time and 0.7% less likely to be income-poor.

Gender is associated with the incidence of poverty in child time. The coefficient of the male indicator shows that fathers are 12.0% more likely to be child-time poor. That is, in general more fathers than mothers spend less than 175 minutes per day with their children. Note that gender is not significantly associated with household income, but being a lone parent significantly increases the likelihood of being poor in child-time (by 4.13%) and in household income (by 20.7%). Lone parents are more likely to fall below the threshold in child-time although they were not significantly spending less time on average with their children. As the age of the youngest child increases, parents are 1.69% more likely to be poor in child-time, but this is more likely related to changes in family dynamics as

Table 2-5: Determinants of Poverty Incidence Probit likelihood 2010 – 2015 (SE).+

	Child-time	Household Income
Immigrant	0.0332 (0.0352)	0.268*** (0.0269)
Years since migration (ysm)	0.00163 (0.00301)	-0.00663** (0.00242)
Not stated ysm	0.121 (0.233)	0.0908 (0.140)
Less than HS	0.00892 (0.0267)	0.116*** (0.0204)
High School	-0.0110 (0.0205)	0.0599*** (0.0153)
Bachelor	-0.0289 (0.0191)	-0.0429* (0.0183)
Grad	-0.0246 (0.0182)	-0.0607*** (0.0172)
Age	0.0000589 (0.00125)	-0.00239* (0.00110)
Male	0.119*** (0.0138)	-0.0149 (0.0122)
Work hours	0.0248*** (0.00131)	-0.00700*** (0.00133)
Lone parent	0.0413* (0.0201)	0.207*** (0.0141)
Multiple generations	0.0781 (0.0408)	-0.0940* (0.0370)
Number of children	-0.00698 (0.00852)	0.0333*** (0.00717)
Age youngest child	0.0169*** (0.00198)	0.000499 (0.00184)
Yr15	-0.0692*** (0.0136)	-0.0511*** (0.0118)
CMA	-0.0255 (0.0151)	-0.0641*** (0.0132)
Province	Yes	Yes
Observations	5,500	5,500

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.

children grow. The number of children and multiple generations present in the household are not associated with the incidence of child-time poverty. However, as the number of children increases, the likelihood of income poverty raises – by 3.33% - and multigenerational families 9.4% less likely to be poor in income.

Overall, human capital and household characteristics impact a household's poverty risk in child-time or household income in an expected way - the likelihood of poverty in child time is positively associated with male parents, work hours and the age of the youngest child and that for household income is positive for lower education levels and the number of children. Furthermore, immigrant parents are not statistically different from native-born parents on average child-time or poverty in child-time but are earning less on average and are more likely to be income poor net of the effect of human capital and household characteristics.

Phipps and Burton (2011) show that average work hours increased more for households at the lower end of the income distribution. Given the competing nature of work and time, their result suggests that inequality increased more than what is implied by income measures alone. Plausibly, we might anticipate a similar reduction in child-time for households at the bottom of the distribution. Further, Burton and Phipps (2017) show that children from households in lower deciles have not experienced an increase in government transfers that could compensate for reductions in child-time - compared to children from households in higher income deciles. To get a better sense of the joint distribution of both dimensions in our case, we compute average minutes by income quartiles and deciles in Table 2-6. We find that the average amount of time parents spend with their children is successively less at higher household income quartiles and that immigrant parents spend approximately 30-60 minutes less time on average than native born parents at every quartile and, with the exception of the lowest decile, the difference is significant. At the second and third deciles, around $25,000, which is close to the poverty line, immigrants are spending approximately 50 and 127 minutes less in the presence of their children compared to native born parents, and the difference is highly significant. This is consistent with results in Phipps and Burton (2011, 2017) suggesting that inequality in time is more intense in income deciles close to the poverty.

Table 2-6: Average Child-time Minutes by Household Income Decile and Place of Birth 2010 – 2015 (SE).+

Quartile	Foreign Born Parents	Canadian Born Parents	Difference
0 – $29,068	164.14 (14.57) 440	220.33 (11.98) 1,042	-56.19** (18.868)
$29,077 - $46,188	141.51 (15.98) 312	193.44 (10.03) 1,084	-51.93** (18.865)
$46,199 - $65,293	102.80 (15.85) 233	158.91 (9.12) 1,080	-56.11** (18.284)
$65,319 - $391,893	107.43 (14.36) 250	143.25 (8.98) 1,059	-35.82* (16.932)
Decile	**Foreign Born Parents**	**Canadian Born Parents**	**Difference**
0 – $17,888	191.60 (22.742) 214	227.62 (19.823) 420	-36.02 (28.034)
$17,895 - $25,718	162.89 (23.484) 164	211.53 (16.761) 396	-48.64** (23.702)
$25,719 - $32,458	97.94 (18.346) 135	224.43 (19.943) 401	-126.49*** (28.203)
$32,460 - $39,912	119.74 (23.453) 113	169.89 (14.463) 448	-50.15* (20.453)
$39,959 - $ 46,188	182.15 (29.390) 126	203.93 (15.607) 461	-21.78 (22.072)
$46,200 - $52,500	114.10 (29.984) 91	172.70 (15.033) 409	-58.60** (21.259)
$52,537 - $60,075	106.54 (20.905) 90	155.81 (13.840) 449	-49.27* (19.573)
$60,091 - $71,554	107.35 (23.587) 99	154.32 (16.184) 437	-46.97* (22.887)
$71,685 - $89,004	75.93 (17.285) 95	128.23 (13.106) 408	-52.30** (18.535)
$89,006 - $391,893	128.92 (26.804) 108	144.42 (13.043) 436	-15.5 (18.445)
Observations	1,235	4,265	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income response and outliers of Household Income removed.

2.6 Results

To construct a multidimensional poverty line (in income and child-time) we estimate a CES utility function which allows for compensation using the Kmenta (1967) method of linear approximation as in Merz and Rathjen (2014a and 2014b). We use GSS time-use 2010 and 2015, which are the only time-use cycles that collect both a quantitative variable for household income and a variable for personal life satisfaction.

The first step in computing a CES-form utility function as the multidimensional poverty line with the Kmenta (1967) approximation method is to obtain least squares estimates of the relationship between life satisfaction and the poverty dimensions (household income, and child-time) plus the Kmenta correction factor (equation 3). The estimated coefficients are reported in Table 2-7. These coefficients have the expected sign and only household income is statistically significant. Spending time with your children and household income in the family are positively related to the happiness of parents. A one percent increase in household income will increase personal life satisfaction by 6.0%, whereas a one percent increase in child-time will increase personal life satisfaction by 0.17%. The magnitude of the correction factor is close to zero and statistically insignificant.

Table 2-7: Reduced Form Estimation by Regression OLS 2010 – 2015 (SE).+

Ln U	**Coefficients**
Ln I	0.060*
	(0.02)
Ln T	0.017
	(0.03)
$[\ln I - \ln T]^2$	0.0000115
	(0.003)
Constant	1.256***
	(0.11)
Observations	5,031

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income and nonzero Child Time.

Next, we use the estimated coefficients to compute the structural parameters using equations (4) to (7), shown in Table 2-8[23]. The elasticity of substitution, $\hat{\sigma}$, is 1.002 ($\hat{\rho}$ is -0.0018), meaning that if the relative price of child-time increased by 1%, the ratio of household income to child-time minutes would increase by 1.002%.[24] This number suggests that household income and child-time are not easy substitutes. Thus, if child-time becomes more expensive (relative to household income), parents tend to not change the amount of time spent with children. The returns to scale parameter, $\hat{v}$, is 0.077, meaning that if consumption (of household income and child-time) doubled, utility would raise by 5.5%. [25] In other words, parents doubling their factor inputs of time and money increases utility, albeit by an amount that is less than double. Note the estimate of elasticity of substitution is approximately 1 (the curvature parameter is approximately zero) and the three criteria for mathematical validity of the Kmenta (1967) approximation hold.

Finally, the estimated parameters in Table 2-8 and the chosen poverty lines for household income and for child-time are used to construct the isopoverty line given in equation 11.[26]

$$u_{poor} = f\left(I_{poor}, T_{poor}\right) = 3.51.\left(0.784.25{,}000^{.002} + .216\,.175^{.002}\right)^{\frac{.077}{.002}} = 7.05 \quad (11)$$

Under the compensation approach, a parent is multidimensional poor if the individual's utility – computed using their own household income (I_i) and child-time level (T_I) – is less than the computed value of 7.05. This means that even if we allow for a trade-off in above poverty level consumption in child-time/household income to compensate for a below poverty level consumption in household income/child-time, a parent with a level of utility less than 7.05 is multidimensional poor.

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[23] See Appendix B, Table B5 for alternative CES parameters estimated by NLS Regression. Starting values of NLS Regression set by the structural parameters of the Kmenta approximation method in Table 2-8.

[24] A relative price is an opportunity cost, so the relative price of spending time with children with respect to earning household income is the income forgone.

[25] Returns to scale, $f(k.I, k.C) = u.k^{v}$ with k as a scalar for example, if $u = 10$, $\hat{v} = 0.077$, and inputs doubled with $k = 2$, $then$, $f(2I, 2C) = 10 \times 2^{0.077} = 10 \times 1.055 = 10.55$ and utility increases has increased by 5.05%.

[26] As indicated before, poverty thresholds are set at 60% of the median for both variables ($25,000 household income per year and 175 minutes per day of child-time).

Table 2-8: Structural Form Coefficients 2010 – 2015 (SE).+

Constant	
$\hat{\gamma} = e^{\hat{\alpha}_0}$	3.512^{***} (.39)
Returns to scale	
$\hat{v} = \hat{\alpha}_1 + \hat{\alpha}_2$	$.077^{***}$ (.01)
Input coefficient	
$\hat{\delta} = \frac{\hat{\alpha}_1}{\hat{\alpha}_1 + \hat{\alpha}_2}$	.784 (.34)
Curvature parameter	
$\hat{\rho} = (-2)\frac{\hat{\alpha}_3}{\hat{\alpha}_1 - \frac{\hat{\alpha}_1^2}{\hat{\alpha}_1 + \hat{\alpha}_2}}$	-.002 (.39)
Substitution elasticity	
$\hat{\sigma} = \frac{1}{1 + \hat{\rho}}$	1.002 (.39)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

$^{+}$Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income and nonzero Child Time.

We consider three different indicators of multidimensional poverty using alternative approaches. An indicator for being multidimensionally poor under the compensation approach is denoted with a "compensation" indicator, an indicator for being multidimensionally poor under the union approach, defined by being poor in either dimension, is denoted with a "union" indicator, and an indicator for being multidimensionally poor in both dimensions under the intersection approach, is denoted with an "intersection" indicator.

Table 2-9 shows the marginal effect of the same set of human capital and household characteristics used above, on the incidence of being multidimensionally poor, defined under the different indicators.[27] Parents that fall short of both the poverty line in household income and the poverty line in child-time – the intersection approach – are the hard-core of multidimensional poverty. Poverty in both dimensions is a particularly vulnerable state and well-being is undoubtedly less than that of non-poor parents. Using the intersection approach to multidimensional poverty, immigrants are 4.66% more likely to be simultaneously poor in both child-time and household income with respect to Canadian-born parents and the result is highly significant. Lone parents are 4.44% more likely to be poor in child-time and household income with respect to parents with partners.[28] Parents are significantly less likely to be poor in both dimensions with a Bachelor (2.37 % less likely) or Graduate degree (1.89% less likely) and more likely to be poor in both dimensions with a high school diploma or less, although this result is not statistically significant.

Immigrants are also more likely than Canadian born parents to be multidimensionally poor under the union and compensation approaches as well. For instance, immigrants are 26.0% more likely to be poor than the native born under the union approach, and 20.0% under the compensation approach. Compared to results under unidimensional approach (table 2-5) immigrant parents experience lower poverty incidence when compensation for income deprivation with the time spent with their children is considered in the definition of poverty (an approximate drop of 7 percentual points).

Lone parents are a particularly at-risk group for poverty, being 19.3% and 18.4% more likely than two-partner parents to be multidimensional poor under the union and compensation approach respectively, whereas it is 4.4% under the intersection approach. Note the similarity of these estimates with those obtained under the unidimensional measures of poverty in income and child-time in Table 2-5 (4.10% and 20.7% respectively). This suggests that lone parents are unable to make up for poverty

[27] See Appendix B, Table B6 for the determinants of the incidence of multidimensional poverty under the compensation approach using Non-Linear least squares to obtain the parameters for a multidimensional poverty line. The starting values were set as in Table 2-8. The results do not change from those estimated using the multidimensional poverty line under the compensation approach by the Kmenta (1967) approximation method.

[28] It is worth noticing that the definition of household income used here does not include child-support payments made by ex-spouses, which would increase household income in lone parent households.

Table 2-9: Determinants of Multidimensional Poverty Probit Likelihoods 2010 – 2015 (SE).+

	Compensation	**Union** Poor in either	**Intersection** Poor in both
Immigrant	0.199***	0.260***	0.0466***
	(0.0234)	(0.0396)	(0.0117)
Years since migration (ysm)	-0.00549*	-0.00579	-0.000517
	(0.00216)	(0.00353)	(0.000981)
Not stated ysm	0.0662	-0.112	++
	(0.143)	(0.157)	
Less than HS	0.0918***	0.123***	0.0163
	(0.0187)	(0.0338)	(0.00916)
High School	0.0429**	0.0358	0.00483
	(0.0135)	(0.0226)	(0.00724)
Bachelor	-0.0144	-0.0410	-0.0237*
	(0.0155)	(0.0230)	(0.00931)
Grad	-0.0397*	-0.0654**	-0.0189*
	(0.0161)	(0.0216)	(0.00912)
Age	-0.000897	-0.00289	0.0000480
	(0.00104)	(0.00154)	(0.000535)
Male	0.00810	0.0547***	0.0200**
	(0.0112)	(0.0165)	(0.00686)
Work hours	-0.000621	0.0148***	0.00309***
	(0.00122)	(0.00174)	(0.000708)
Lone parent	0.184***	0.193***	0.0444***
	(0.0124)	(0.0228)	(0.00767)
Multiple generations	-0.0883*	-0.0558	-0.00628
	(0.0358)	(0.0500)	(0.0132)
Number of children	0.0323***	0.0328***	0.00921*
	(0.00681)	(0.00955)	(0.00401)
Age youngest child	0.00218	0.0114***	0.00262**
	(0.00175)	(0.00248)	(0.000914)
CMA	-0.0523***	-0.0575**	-0.0140*
	(0.0116)	(0.0177)	(0.00650)
yr15	-0.0512***	-0.0932***	-0.0237***
	(0.0105)	(0.0160)	(0.00627)
Province	Yes	Yes	Yes
Observations	5,031	5,031	5,031

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household income removed, nonzero Household Income and nonzero Child Time.

++ Zero observations are multidimensionally poor under the intersection approach and have not stated ysm. CES coefficients by Kmenta Approximation Method

risk in child-time in terms of income. By education level, we find the same pattern when using the compensation and union approach as we did when using the intersection approach – a positive relationship between education levels, household income and child-time. Furthermore, the magnitude on the lowest education level (less than a high school diploma) decreases to 9.18% once compensation for lack of income with child-time is considered.

Fathers are 5.5% more likely to be poor in either dimension and 2.0% more likely to be poor in both dimensions than mothers and both results are statistically significant. Once compensation between factors is considered, however, mothers and fathers are equally likely to be (multidimensionally) poor. This supports the notion that although males have higher incidence of being poor in child-time (by around 12%, see table 2-5), this is compensated by additional household income.

The relation of work hours to poverty is small but significant under the union and intersection approach – a further one hour of work increases poverty by 1.48% and 0.3% respectively. Not surprisingly, under the compensation approach, which allows income to compensate for lack of child-time, work hours are no longer a significant result on the incidence of multidimensional poverty. Households with multiple generations share an insignificant relationship with multidimensional poverty in one or both dimensions, but when compensation is allowed, are 8.83% less likely to be multidimensional poor. This indicates that another adult present in the household allows for compensation between resources.

Beyond estimating the likelihood of multidimensional poverty risk with the compensation approach, an interesting question to explore is to estimate the marginal effects of parental characteristics on parents' ability to substitute deficiencies in household income (child-time) for above poverty threshold levels in child-time (household income) and hence to become non-poor in a multidimensional sense. Using the multidimensional poverty line and the threshold poverty lines in child-time and household income, we sort parents into one of six mutually exclusive poverty regimes as shown in Figure 2-1. Poverty regime 1 corresponds to households that are simultaneously below the poverty line for child-time minutes and the household income. Poverty regimes 2 and 4 correspond to parents that earn below poverty threshold levels of income but above threshold levels of child time. However, households in poverty regime 4 spend enough time with their children to become non-poor under the compensation approach. Poverty regime 3 and 5 designate households where parents spend less time with their children than what is defined by the poverty threshold but have income above the poverty

threshold. Here, households in poverty regime 5 earn enough income to compensate for the lower levels of time spent with their children so are non-poor in a multidimensional sense. Finally, regime 6 designates households that are non-poor in both dimensions. Using these six poverty regimes, we define a variable denoted "regime", and estimate the effect of household and human capital characteristics on the incidence of belonging to one of these 6 regimes using a multinomial model.

Table 2-10 shows the multinomial logit marginal effects of an immigrant identifier on the likelihood of belonging to one of the six poverty regimes, relative to Regime 6 – being non-poor in income and non-poor in child-time.[29] The benchmark model only includes the indicator for immigrant status and we successively add determinants of human capital (HC) and household characteristics (HH) covariates to the model to highlight the relevance of different factors on the likelihood of poverty regimes.

From the fully specified model with both household and human capital characteristics as covariates, immigrants are 5.33% more likely than Canadian born parents to be in regime 1, simultaneously poor in both time and income and the result is statistically significant. This result is particularly troubling as simultaneous deprivation does not allow for compensation with a more abundant resource to improve well-being. Given that immigrants in Canada are more likely to be income poor compared to otherwise similar Canadian born individuals (26.8% Table 2-5), we examine the likelihood of regimes 2 and 4, the later allowing for the possibility of compensation with child-time. We find that immigrant parents spend sufficient time with their children to compensate for income deficits in some instances as immigrant parents are 7.09% more likely than Canadian born parents to make the substitution – regime 4 – with respect to being non-poor in both (regime 6) in the fully specified model. However, immigrant parents are also 13.3% more likely than Canadian born parents to be in regime 2, relative to regime 6, and hence being more likely to lack the ability to substitute enough child-time to compensate. Predictors of the number of adults or children in the household are statistically significant in the likelihood of regime 2 – lone parents 12.2% more likely, multiple generations 10.7% less likely and, as the number of children increases, households are 20% more likely to be in regime 2 – with respect to regime 6.

[29] See Appendix B, Table B7 for the determinants of poverty regimes using Non-Linear least squares to obtain the parameters for a multidimensional poverty line. The starting values were set as in Table 2-8.

Table 2-10: Determinants of Poverty Regimes Multinomial Logit 2010 – 2015 (SE).+

	R1	R2	R3	R4	R5
Immigrant	0.0240***	0.0591***	0.00458	0.0401***	0.00188
	(0.00683)	(0.00931)	(0.00356)	(0.00930)	(0.0153)
			+ Household:		
Immigrant	0.0258***	0.0651***	0.00499	0.0427***	-0.00769
	(0.00663)	(0.00926)	(0.00386)	(0.00911)	(0.0140)
			+ Human Capital:		
Immigrant	0.0368**	0.128***	-0.00114	0.0720***	-0.101*
	(0.0124)	(0.0187)	(0.00967)	(0.0174)	(0.0402)
			+ Household and Human Capital:		
Immigrant	0.0481***	0.123***	0.00178	0.0613***	-0.0519
	(0.0124)	(0.0181)	(0.00950)	(0.0174)	(0.0363)
			+ Household and Human Capital and Geography:		
Immigrant	0.0533***	0.133***	0.00135	0.0709***	-0.0534
	(0.0118)	(0.0180)	(0.00996)	(0.0177)	(0.0359)
			+ Household and Human Capital and Geography and Multiple generation interaction:		
Immigrant	0.0724**	0.179***	-0.00130	0.0731**	-0.0585*
	(0.0247)	(0.0342)	(0.00914)	(0.0257)	(0.0281)
Multiple generation	-0.00633	-0.0638***	0.00687	-0.0157	0.0287
	(0.0101)	(0.0121)	(0.0179)	(0.0211)	(0.0399)
Observations	5,031				

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income and nonzero Child Time. CES coefficients by Kmenta Approximation Method

Human Capital covariates: years since migration, years since migration squared, not stated years since migration, less than a high school diploma, high school diploma, bachelor's degree or higher than an bachelor degree and age of the respondent. Household covariates: male, work hours of the respondent, lone parent status, multiple generations living in the household, the number of children in the household and age of the respondent's youngest child. Geography covariates include province and Census Metropolitan Area interactions. All models include a covariate for year.

Note: Estimated values of the model covariates in rows 2 to 5 are reported in Appendix B, Table B1- Table B4.

The results are similar for all model specifications, although they vary in magnitude. Models including human capital characteristics generally produce higher levels of poverty among immigrants. By successively adding determinants of human capital to the model with an immigrant indicator, human capital characteristics seem to be driving the result on the ability of immigrant parents to overcome income deficiencies by substituting time spent with children compared to native-born Canadian parents. Controlling for human capital characteristics approximately doubles the likelihood of immigrants being in region 2 and 4 – from 6.51 percent to 13.3 percent and from 4.27 percent to 7.09 percent respectively.

Table 2-3 shows that immigrant households are more likely to have an additional adult in the family. This represents an additional source of time for the household that can relax the time budget constraint. An additional adult may be able to work, generating more income for the household, or may provide child services, liberating parents to work. To assess the effect of an additional person in the time resources of the family, we include an interaction term between the immigrant indicator and multiple-generation household indicators and re-estimate the model. Although immigrant houses with an additional adult have 18 more minutes to spend with children than Canadian households with an additional adult, they also have lower incomes (Appendix B, Table B8). This additional time, however, reduces the likelihood of being in poverty regime 2 (by 6 percent) and increases the likelihood of being in poverty regime 4 (although not significantly). Hence, even if households are "richer" in terms of time resources, it is not enough to make these families "non-poor" in a multidimensional sense. Having an extra adult in the household also increases the likelihood of being in poverty regime 5, that is able to compensate low time resources with additional income (although not significantly). Note that immigrant families with no additional adults are now more likely to be poor in both dimensions (i.e. belonging in poverty region 1) as well as in poverty region 2.

The next section concludes and discusses policy implications.

2.7 Conclusion

Parental inputs in the form of monetary and nonmonetary resources are important for children's outcomes as adults. Specifically, the empirical evidence supports that the time parents spend in the presence of their children is a particularly important source for children's skill development. In the production of well-being, a trade off exists between the amount of time that can be devoted to children and monetary resources that can be brought into the household. In view of the increasing concern about the inequality of income and hours of work in current society, well-being measures based on income

and time resources seem particularly relevant to learn about the well-being of children. This paper estimates and compares several measures of multidimensional poverty among Canadian households and the determinants of multidimensional poverty. We focus on the differences between immigrant and non-immigrant families as immigrants comprise a large portion of the Canadian population. Further, recent research finds that immigrant parents in Canada have higher rates of low income than Canadian-born parents, which might compromise the social and economic mobility of second-generation immigrant children. It is plausible, however, that immigrant parents increase the time input in child rearing to make up for low income, and our multidimensional measure of poverty helps assessing this possibility.

Consistent with ordinary measures of poverty, our results show that immigrant households are more likely to be poor in income than Canadian-born households (26.8% more likely). However, considering the time parents spend with their children as compensating for income poverty, immigrant parents have sufficiently high levels of child-time that can partially – but not completely - atone for low levels of household income and a multidimensional poverty incidence shows lower incidence of poverty (20 per cent). It is worth mentioning that an indicator for *multiple generations present in the household* is a significant determinant of reduced likelihood of belonging to a poverty regime where there is not enough child-time to compensate for low levels of income. Further, we estimate the elasticity of substitution between income and child time to be approximately one (1.002), suggesting that parents do not change the time spent with children in response to an increase in the cost of time (an increase in labour income, for instance).

Put together, these results suggest that although immigrant families struggle to raise above poverty levels, they maintain high levels of time investments on childrearing. It is possible that immigrant families are less willing to sacrifice child-time investments in favour of labour market engagement, which may limit labour market integration. This could be the case because they lack family networks that can provide affordable child-time investments. Hence, policies that contribute to reduce the cost of childcare for immigrant families might be most beneficial for alleviating poverty in terms of child-time and income

Chapter 3
Time-use of Parents and Young Adults 1986-2015

Allison Mascella

3.1 Introduction

Over the past fifty years the labour market has transformed significantly with the incorporation of women in the labour force, which has in turn had significant repercussions for the functioning of families. In particular, the education levels, wage rates and intergenerational mobility of children depend significantly on parental inputs into children's development of cognitive and non-cognitive abilities. However, the neoclassical labour economics trade-off between time spent in the labour force and time spent on leisure activities fails to consider the importance of household production as a distinct activity that may have long term effects. Specifically considering the allocation of time between different activities chosen by mothers and fathers is necessary to understand all relevant compromises, including those affecting the children. Further, time allocation within families may have a strong cultural component and cultural differences between immigrant and Canadian-born parents surrounding decisions on work, household chores, social activities and child upbringing have a differential effect on their children's outcomes as adults. In this paper I explore differences in immigrant/native-born parental time spent with children to assess the effect of cultural factors, as mediated by gender.

Models of utility maximization in household economics and the derivation of time-use demand equations have evolved from a labour-leisure trade-off to include household production and more recently, child services as separate time-use categories. Distinguishing the effect of time spent with children from other household production services is essential to understand the impact of policies that influence the allocation of time. Pooling together all household production will fail to highlight the importance of high, long-term impact activities such as reading to or playing with children. Here, I define four time-use demand variables pertinent to understanding time-use decisions made by households, using General Social

Survey (GSS) time-use cycles 1986-2015. These GSS cycles record an exhaustive list of respondents' daily activities and the minutes spent on each activity over one 24-hour period. I use this information to categorize activities into four major time-use categories: paid work; household production; leisure; and child services. Both, time invested in market employment and in daily chores and emotional care of family members constitute large time investments and are necessary actions for the maintenance and growth of the household. In general, there is no substitute for care given to young children akin to that provided by the parents – as it is the case for household production activities – and therefore, it is now common place to consider child services as a separate time-use demand function. I am interested in this category of time use since care given to children, particularly by the mother, can impact children's current and future outcomes as adults.

I illustrate trends in these four categories of time-use over the sample period. I document the change in traditional gender roles, with fathers' involvement in household production and child services increasing. Both genders have experienced a decrease in time spent in leisure activities. For mothers, both average time spent in paid employment and in child services has increased over time. The "second-shift" phenomenon of mothers employed in paid work and, at the same time, upholding the child caregiving as mothers, is reflected in the form of decreasing average time spent in leisure and in household production by mothers. The system of time-use demand functions that I estimate in this paper considers four pertinent time-use categories of parental time-use allocation, and as such there is an inherent trade-off embedded in time-use decisions. Specifically, for parents, the decision to spend time caring for children is made at the expense of time spent in paid work, leisure, or household production.

Further, Canada is a country with a large population of immigrants from varied source countries and the evidence suggests that cultural factors may affect time-use decisions. If parents born abroad allocate time differently, these differences can have an impact on second-generation Canadian children and may have long term effects in human capital accumulation and social and economic integration of children in the host country. Further, these cultural influences in time-use decisions may be different depending on source country region and

intensify or attenuate with time spent in Canada (Pailhé et al. 2018, Busetta et al. 2018, Blau et al. 2020.)

Results show that differences in time-use between immigrants and native born are likely to reflect differences in cultural approaches to time-use allocation. Further, differences between mothers and fathers born abroad are likely the result of differences in the disruptions in behaviour associated with the immigration process. I find that place of birth and years since migration have the largest effect on leisure time, with parents born abroad spending approximately 24 minutes less in leisure activities than Canadian born parents, results that are driven by mothers. The immigrant-native born differences show considerable heterogeneity among parents. I further estimate results with and without years since migration and find that mothers respond differently to the length of time spent in Canada than fathers do, with marked differences with respect to birthplace region of origin. While the leisure time of immigrant mothers increasingly diverges from that of Canadian-born mothers with time spent in Canada, fathers' leisure time converges to that of Canadian-born fathers. At the same time, for both mothers and fathers, there is an insignificant effect of time spent in Canada on child service. This suggests that immigrant-native born differences in time-use is due to a cultural approach and that differences in time use of mothers and fathers may be involved in the process of integration to the host country.

A major policy concern in immigration regards the integration of the children of immigrants in the host country (Hou and Bonikowska, 2016; Lythra and Soehl, 2015; Hou and Garnett, 2010). However, time allocation of the second generation is a dimension of integration not much researched in the literature. The time young adults devote to paid work, household production, leisure and educational activities is associated with economic and social success and is persuaded by the preferences of their parents. To see whether second generation immigrants also show different time allocation choices, I investigate the time-use allocation decisions of young adults ages 15-25 years old. I estimate time-use categories for young adults, distinguishing between those with Canadian-born parents and second generation immigrants, those with one or two parents born abroad and find that second generation immigrants spend more time on education activities and less time in paid work, relative to young adults raised by

Canadian-born parents. This result differs by birth region of origin as youths with an Asian-born mother or father spend 41 and 31 less minutes in paid work and 54 and 48 more minutes on education related activities respectively.

The next section provides a summary of the literature. Section three and four presents the empirical model and the data used in this analysis respectively. Section five presents the result of the analysis. The final section concludes.

3.2 Literature

The trade-off between time spent in the labour force and time spent on leisure activities is one aspect of time-use commonly addressed by labour economic models. However, understanding the labour force decisions of households, particularly women, requires the separation of time spent in the labour market from time spent on leisure *and* from time spent on household services. While work in the market provides income for family needs, care for children and preparation and functioning of daily life also constitute a large time investment that contributes to the well being of the family. Children spending more time with their parents, particularly their mother, show positive current and future outcomes (Todd and Wolpin 2006, Cuhna and Heckman 2007, 2008). However, a decision to spend more time with children comes at the cost of less time spent on other activities and vice versa.

Neoclassical economic theory first modelled the decision between time spent at work and time spent in other activities through the labour-leisure model, in which individuals decide the allocation of time between the two activities depending on the wage rate for market work. This initial model failed to acknowledge home production. However, a large portion of time not spent in paid employment cannot be categorized as leisure. Specifically, home production results in a series of tangible and intangible goods and services (meals, child and adult care, resilience, support network) that directly generate utility for the family and society (Becker 1965, Lancaster 1966, Muth 1966 as cited in Gronau, 1977).

Becker (1965) specifically considered the household context and outlines the trade off between parents' time allocated to work and time allocated to home production. In Becker's model, the time resources of the family must be allocated to work and household production,

and each parent faces an individual wage rate and an individual return to household activities. As a result, optimal decision-making states that the parent with a comparative advantage in the market – highest wage rate – should specialize in work outside the home. This model is the basis of modern theories of family formation and has proven relevant in investigating determinants of female labour participation (Fernández and Fogli 2009, Cigno 1991, Heckman 1974, Leibowitz 1974).

Becker's model, however, did not make a distinction between household work and leisure, likely due to lack of time-budget data to define these categories appropriately and because it had not yet been shown that the distinction would provide any further understanding of household behaviour. Gronau (1977) provides two theoretical conditions under which aggregation of leisure and home production is acceptable – if correlations with socioeconomic and environment factors are similar and if their relative prices are constant. In practice it is doubtful that these conditions are met. In fact, his 1976 study, using time diary data to estimate the socioeconomic and environmental effects on four major time-use categories (paid work, household production, leisure, and child care) shows that these effects differ between household production and leisure (Gronau 1976). The study also shows that it is misleading to consider maternal employment as an indirect measure of time devoted to children and that increasing the former does not automatically reduce the later. In fact, maternal employment is not an accurate estimation since working mothers spend only slightly less total time with their children, most work time being offset by mother's leisure and other household production services, (Hill and Stafford 1985; Datcher-Loury 1988; Sandberg and Hofferth 2001 as cited in Villena-Roldán and Ríos-Aguilar 2012). Detailed time-diary data provides for separate time-use categories of time spent working at a job and time spent with children to avoid the need to proxy the lack of mother's time spent with children with work hours as well as to avoid any bias in self-reported time spent with children.

Our current understanding of parental time-use recognizes the importance of time spent by parents with their children and models this time as a separate time-use category, which yields utility directly. Kimmel and Connelly (2007) model child services as the output of a production function that uses a combination of childcare time and market produced child goods

as inputs. Specifically, childcare production depends on time provided by the mother and separately, time provided by all other caregiving sources which are nonmaternal, such as teachers and fathers as well as tangible goods bought in the market. The efficiency of the household's production function for child services depends on the parent's productive ability with resources of time and money, which can differ across parents. Introducing a separate equation for child services apart from household production in the system of household time-use equations explicitly recognizes that a parent's time served to the children in their household has a poor substitute if bought in the market and empirically, it allows to estimate a different association with economic and demographic factors (Busetta et al. (2019), Kalenkoski et al (2005A) and Kimmel and Connelly (2007)).

Further, the literature recognizes child service as one potential mechanism that improves children's current and future outcomes. Theoretical models on child skill formation define parental time spent with children as an investment that stimulates children's cognitive and non-cognitive skills which, in turn, bring positive learning, behavioural outcomes and economic outcomes (Todd and Wolpin, 2006, Cuhna and Heckman 2007,2008). In Cuhna and Heckman's model, parental inputs of time simultaneously interact with family background to determine children's outcomes, and in Todd and Wolpin, parental time-use is written as an input into the production function for cognitive and non-cognitive skills. Heckman et al. (2010) and (2013) document improved economic outcomes of education, employment, and earnings as the effects of an early intervention public program administered to preschool children.[30] The program was designed to encourage mothers to support the socioeconomic development of their children using types of play which require engagement with parents. The results suggest that the interaction influenced the non-cognitive skills of children, which are accredited with improved labour market behaviours as boosts in IQ faded a few years after the program finished.

Care for children provided by the mother as a means to impact children's future success as adults is well-documented in the literature and, at the same time, to incorporate mothers in

[30] The Perry Preschool intervention program was to involve mothers in the socio-emotional development of their children and was administered in 1.5 hour weekly visits by teachers to the homes of disadvantaged preschool children and 2.5 hour sessions held 5 days a week in pre-school (Heckman et al 2013).

the labour force, the involvement of other caregivers providing time for household production, can support the perpetuation of child caregiving. For both attached and unattached parents, there is causal evidence of social policy in Canada shifting gendered practices in time-use performed by fathers. For instance, following a change in paternity leave policy in Quebec, Patnaik, 2019 and Wray 2020 estimate a 250% increase in paternity leave participation and an increase of 2.2 hours per day in father's solo parenting time respectively. In this paper, I intend to explore gender differences in parental time-use by estimating results separately mothers and fathers to promote gender equality in care and household work.

Building on previous work regarding the importance of considering a more detailed taxonomy of time-use, this work considers that cultural factors significantly affect time-use allocation decisions of mothers and fathers. International evidence from the USA, United Kingdom, France, Italy, and Sweden provides evidence that categories of parental time-use vary by characteristics of the parent, household, country and culture (Kimmel and Connelly 2007, Kalenkoski et al. 2005,2007, Hallberg and Klevmarken 2003, Pailhé et al. 2018, Busetta et al. 2018, Blau et al. 2020). For example, Pailhé et al. 2018 find that mothers and fathers in Italy experience a more pronounced gender gap in household work and a larger loss in free time by the presence of children than parents in France. The authors point to normative determinants such as notions of being "good parents" and the public view of pre-school children suffering if their mother works are held stronger in Italy than in France. In Canada, empirical research on intergenerational education transmission between parents and their children also suggests important cultural differences. The relationship is weaker for immigrant families than for families with native-born parents (Aydemir, Chen and Corak, 2008), indicating higher educational mobility opportunities for second-generation immigrant children. Overall, the children of immigrants also have higher rates of university completion compared to their Canadian-born peers however, there is significant heterogeneity in this result by ethnicity and immigrant entry class. Boyd (2009) finds that second generation immigrant children from non-traditional immigrant receiving countries – outside United States, United Kingdom and Europe – complete more years of schooling compared to third generation immigrant children and compared to their immigrant mothers and fathers. Chen and Hou

(2019) find that the largest increase in university completion rates are held by Chinese, Korean and South Asian second generation daughters and Chinese and Korean second generation sons.

Overall, this suggests that countries with large immigrant populations, such as Canada, may show important heterogeneous effects in terms of time-use allocation that will affect households' responses to policies aimed at the well-being of families. If households have a cultural preference to spend more time with children or in household production, this time must come from leisure or market work. This difference in a parent's time spent with children due to cultural factors could have an impact on family immigration experience and with economic and social integration.

As mentioned above, allocation of time-use into paid work, home production, leisure, and child service of parents is one mechanism through which transmission onto children's outcomes occurs. The literature documents parent's behaviour and beliefs as impacting the present and future choices of children regarding their own time-use patterns. Cordoso et al. (2010) estimates intergenerational transmission of preferences in time spent reading, studying, socializing, and watching TV in Italy in Germany and France and finds a widespread influence of parent's time on their teenaged children's time use in these categories and the result is especially strong from mother-to-child and Farre and Vella (2013) finds the attitudes and beliefs surrounding gender roles and female labour force participation of mothers is correlated with that of her sons and daughters. Further, qualitative evidence in Toronto describes South Asian parents as exerting authoritative influence and pressure for high family status and prestige and New York children of Chinese immigrants grow-up in a social enclave where post-secondary completion is the norm and working in a professional occupation is a minimum level of achievement (Somerville and Robinson 2016 as cited in Kasinitz et al. 2008). Since the production of cognitive and non-cognitive skills in children depends both, on their own time-use patterns (Harding, 1997, Hofferth and Sandberg 2001b) and characteristics of the family, the diversity of activities engaged in by the children of parents born abroad and from specific source regions can provide explanation to their education outcomes as adults. Dynastic motives and aspirations held by newcomers for their children in terms of future outcomes as adults can be seen in the time-use patterns of parents devoting more or less time

to work or time with their children as well as in the time-use patterns of second generation young adults.

Time-use is one of the inputs of the production function for the family that can influence children's cognitive and non-cognitive skills as well as their time-use patterns as young adults. Given Canada's large immigrant population, variation in time-use efforts of parents and children by parent's place of birth can explain family immigrant experience through differences in children's time allocation in the future. This paper intends to show differences by immigration status in time-use decisions of the household and suggests a plausible link between this and children's allocation of time.

The next section discusses the empirical model in time-use systems.

3.3 Empirical Model

Considering a time-use model with four main categories of parental time-use allocation as pertinent choices of time spent: paid-work, household production, leisure, and child services I estimate the marginal effects of characteristics of the parent and household. The parent is the unit of analysis with parents choosing optimal time-use allocations. The system of time-use equations can be characterized by equation (1):

$$t_j = \beta_{oj} + \boldsymbol{\beta}_j^T \boldsymbol{X} + \varepsilon_j \qquad \text{for } j = pw, hh, l, cs \qquad (1)$$

with dependent variable t_j as the total time allocated to the activity j for j = pw (work), hh (household production), l (leisure) and cs (child service). The coefficient, β_{oj} is the intercept and $\boldsymbol{\beta}_j'$ is the vector of marginal effects for each explanatory variable in matrix, $\boldsymbol{X}$.

In time-use data, there is typically clustering around zero minutes spent in an activity. In this case, the dependent variable can be censored from below and modelled as a latent dependent variable. A censoring mechanism that translates latent time-use variables into observed time-use variables captures this discontinuity. That is,

$$t_j = \begin{cases} t_j^* & if\ t_j^* > 0 \\ 0 & if\ t_j^* \leq 0 \end{cases} \quad (2)$$

with latent variable, t_j^* , which is equal to observed variable, t_j, when positive and zero otherwise. The estimation method of equation (1) depends on the assumption of the process that generates equation (2).

Observed zeros in time-use data can be generated by a mismatch between the respondent's schedule and the day of the week the survey was recorded. Alternatively, clustering at zero can be the optimal response of non-participation (or negative participation) at zero minutes chosen by the respondent as the result of their utility maximization problem. When the respondent's personal schedule of weekly activities and the respondent's diary day are a mismatch, the result is a "false zero" in the data set. For example, if a respondent's work schedule is Monday-Friday and their time-dairy was recorded on a weekend, the respondent reports zero minutes as paid work. Due to the window length of one 24-hour time diary in GSS time-use cycles, respondents who participate in the activity but not on the diary day cannot be considered as non-participants, so the data is not censored. In this case, measurement error occurs, and Ordinary Least Squares (OLS) regression is the optimal estimation method, relative to a Tobit regression model. Consistency of parameter estimates in equation (1) requires the correct specification of the conditional probability density function (pdf). In the case of "false zeros", t_j^* is incompletely observed, so OLS is the superior method because it produces unbiased estimates.

On the other hand, zero minutes observed in time-use demand functions can be a "true zero" of non-participation as the result of the utility maximization problem. In this case, t_j^* is completely observed and is the result of a corner solution of zero minutes spent. For example, if a respondent's optimal choice is not to perform any form of household production (or a negative amount) and so reports zero minutes spent in this activity (Foster and Kalenkoski 2013, Stewart 2009). Respondents in the GSS reporting zero minutes in an activity as the result of their optimal choice are considered non-participants, so the process that generated the time-use category is equation (2). In the case of censored data, the pdf is defined to account

for the mass of observations at zero minutes spent with nonzero observations thereafter and the optimal estimation method is by Maximum Likelihood Estimation (MLE). The pdf of the Tobit model is a hybrid of the cumulative distribution function (cdf) and pdf from the normal distribution. For the observed latent dependent variable, t_j, and given $\boldsymbol{x}_i$, the cdf is written as;

$$f(t_j;\beta_j,\sigma|x) = \left\{1-\Phi\left(\frac{x^T\beta_j}{\sigma}\right)\right\}^{1(t_j=0)}\left\{\left(\frac{1}{\sigma}\right)\phi\left[\frac{(t_j-x^T\beta_j)}{\sigma}\right]\right\}^{1(t_j>0)} \quad (3)$$

where Φ is the standard normal cdf and ϕ is the standard normal pdf. Indicator function, $1[.]$, is equal to 1 if the condition in brackets is true and zero otherwise thereby calculating the portion of the cdf when the optimal time-use is zero minutes. The log-likelihood function of the Tobit model maximizes;

$$l(\beta_j,\sigma) = \sum_{i=1}^{n} log\left[f(t_{ji};\beta_j,\sigma \mid x_i)\right] \;\; for\; j = pw, hh, l, cs \; (4)$$

to obtain estimates of the parameters in equation (1) for time-use equation *j* (Cameron and Trivedi 2005, Wooldridge 2002, Foster and Kalenkoski 2012, Stewart 2009).[31]

The literature adopts different views on whether to classify observed zeros as "false zero" or "true zero" and the subsequent choice of estimation by OLS regression or Tobit model. Kimmel and Connelly (2007) specify all four equations – paid work, household production, leisure and child service with a Tobit model as do Kalenkoski et al. 2007 and 2005 in estimating time use in child care and market work. However, more recent research has adopted the "true zero" and "false zero" method as outlined in Foster and Kalenkoski 2012 and Stewart 2009. For example, Pailhé et al. 2018 believes observed zeros are a mismatch in all four equations so uses linear estimates and Busetta et al. 2009 identifies only paid work of women as a

[31] If OLS regression is used in a situation of "true zeros" then the β estimates are inconsistent since the true conditional expectation is nonlinear in $\boldsymbol{x}$, β and σ.

censored variable. I consider the definition of the activity and gender of the respondent performing the activity and the amount of zero minutes reported in time-use variables to classify observed zeros. I assume that for mothers, reporting zero paid work corresponds to a "true zero", and reporting zero household production, leisure or child service is the result of a mismatch. Therefore, I use a Tobit model for mother's time in paid work and OLS in the rest of the equations in the system. For fathers, I specify the equations for household production and child services as Tobit models and the equations for paid work and leisure as OLS regression.[32]

Another consideration in estimating the system of equations (1) is correlation of the error terms across equations. When a parent chooses more time-use in one category, they are simultaneously choosing less time in the other time-use categories (Kimmel and Connelly, 2007; Busetta et al., 2019; Kalenkoski et al. 2005). This assumption has an impact on the variance covariance matrix. To capture interdependence of time-use categories, I specify the error terms as correlated across equations as in (5):

$$\begin{pmatrix} \varepsilon_{cs} \\ \varepsilon_{l} \\ \varepsilon_{hh} \\ \varepsilon_{pw} \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{cs}^2 & \rho_{csl}\sigma_{cs}\sigma_{l} & \rho_{cshh}\sigma_{cs}\sigma_{hh} & \rho_{cspw}\sigma_{cs}\sigma_{pw} \\ \rho_{csl}\sigma_{cs}\sigma_{l} & \sigma_{l}^2 & \rho_{lhh}\sigma_{l}\sigma_{hh} & \rho_{lpw}\sigma_{l}\sigma_{pw} \\ \rho_{cshh}\sigma_{cs}\sigma_{hh} & \rho_{lhh}\sigma_{l}\sigma_{hh} & \sigma_{hh}^2 & \rho_{hhpw}\sigma_{hh}\sigma_{pw} \\ \rho_{cspw}\sigma_{cs}\sigma_{pw} & \rho_{lpw}\sigma_{l}\sigma_{pw} & \rho_{hhpw}\sigma_{hh}\sigma_{pw} & \sigma_{pw}^2 \end{pmatrix} \right) \quad (5)$$

where ρ_{ij} is the covariance of the error terms of equation i with equation j, σ_j is the standard deviation and σ_j^2 is the variance of the error terms of equation j. To account for correlation of the error terms, I estimate the system in equation (1) using a Seemingly Unrelated Regression (SUR) model which I specify as a mixed process with a combination of Regression and Tobit models.[33] Since the Tobit model is built on the classical linear regression model with normally distributed error terms, the Tobit and Classical Linear Regression model can be combined into

[32] Alternatively, I run a model where estimates for fathers use a linear model for child services (instead of Tobit). These results are discussed in section 5.

[33] The Stata package, Conditional Mixed Processing (cmp) estimates a SUR model with syntax to specify an equation in the system as Tobit or Regression (Roodmand 2011).

a multiequation system with the error terms sharing a multivariate normal distribution and estimated by MLE (Roodmand 2011).

OLS regression coefficients β_j are, by definition, the partial effect of the covariate on the conditional expected value of the time-use category *j*, $E[t|\boldsymbol{x}]$. That is, the partial effect in equation (1) for a change in covariate x_i and time-use category *j* is equation (6):

$$\frac{\partial E[t_j|x]}{\partial x} = \beta_j \qquad (6)$$

Since the relationship between x_i and t_j is linear in OLS models, the partial effect is the beta coefficient in equation (6). To compare Tobit model output to OLS, I estimate the average marginal effects on the observed outcome, $E[t|\boldsymbol{x}]$, which uses both the censored observations and the observations in the rest of the distribution to capture the time-use of those that participate (t>0) and those that do not participate in the activity ($t = 0$). The marginal effect I compute for individual *I* and time-use category *j* is as in equation (7) [34]:

$$\frac{\partial E[t|x]}{\partial x} = Prob[t > 0]\frac{\partial E[t|x,t>0]}{\partial x} + E[t|x, t > 0]\frac{\partial Prob[t>0]}{\partial x} \qquad (7)$$

which expresses the change in *x* as composed of two parts - the impact on the conditional probability plus the probability that the observations fall in the positive part of the distribution (McDonald and Moffit 1980 Williams 2012). [35] Equivalently, the partial effect in equation (7) is expressed as

$$\frac{\partial E[t|x]}{\partial x} = \beta_j \Phi\left(\frac{\boldsymbol{x^T\beta}}{\sigma}\right) \qquad (7')$$

[34] Subscript *i* for the individual and *j* for time-use category is supressed for simplicity.
[35] Average marginal effects for the equations estimated with Tobit, are estimated with the Tobit postestimation command margins, dydx(*) with option ystar(a,b) where $t^* = max\{a, \min(y, b)\}$ and modified for the cmp package syntax with reference to equation number.

which is the MLE beta coefficient in equation (4) for variable x in time-use category j multiplied by the proportion of non-limit observations (Greene 2008)[36].

The difference in assumption on the data-generating process of time-use categories dictates the use of OLS vs Tobit estimation of partial effects and regression-adjusted predictions.

3.3.1 Definition of Time-use Categories

Sorting the activities collected by the survey into the four major activity categories requires delineation based on economic intuition and, to aid in comparison with previous results, consistency with that common in the literature (See Appendix C, Table C1a through C1e for definitions and activity codes). For the definition of paid work, there is no consensus in the literature. For example, Kalenkoski (2007) describes paid work as time spent at a job while in Busetta et al. (2019) paid work includes time spent searching for a job. Since I only consider parents with a paying job in the job market or working at home as a homemaker for their family, I define paid work as time spent at the respondent's job - and so includes travel during work as in Kalenkoski et al (2005) but not time searching for a job (see also Kimmel and Connelly, 2007).[37] To be consistent with previous literature, I do not include commute time to and from work to home. Activities included here are paid work and overtime work at the main job and other job(s), travel during work, waiting/delays at work and meals/breaks during work hours.

As in Gronau (1977), time in household production is defined as the time used to generate services that have a close substitute in the market and leisure time as the time used for services that have poor substitutes in the market. Activities included in household production time include such activities as meal preparation, indoor/outdoor cleaning, laundry, shopping, pet care, professional appointments/services and care for household adults aged 15

[36] See Appendix B8 for equations in computing marginal effects when the model includes an interaction term.

[37] Examples of activities provided by GSS for travel during work include, a contractor driving between job sites, travelling to a conference, and delivering forms to hospital offices.

years and older with the assumption that all have available substitutes that can be bought in the market. [38]

In measuring leisure time, I consider *active leisure* as in Kimmel and Connelly (2018) and therefore do not include personal care for the respondent (administered by the respondent to themselves), night's sleep and naps, and meals at home into the definition of leisure. Activities included in this category are, for instance, meals at restaurants, relaxing thinking or smoking, volunteer work, attending entertainment, playing recreational sports, watching tv, listening to music, reading, talking to household members in person and other time spent on media and communication. However, estimates of the differences in *active leisure time* spent by parents born abroad might be misleading if there are cultural differences in the understanding of leisure as an active versus passive activity. For instance, time spent away from work and chores may be preferred to be spent eating meals at home or sleeping rather than watching television or going out for meals thereby, a portion of leisure time is not counted due to cultural differences in time-use choices. To check if the definition of leisure affects the estimates of time spent in different activities, I consider a broader second definition of leisure (*passive leisure*) that adds those activities - eating meals at home, personal care and naps and nights' sleep – to the definition of leisure. Furthermore, the additional leisure activities considered in *passive leisure* adhere to the separation from household production suggested by Gronau (1977) as there are no available substitutes for sleep and personal care and to some extent, meals at home.

In defining child service, one should consider the urgency and unexpectedness of parental time-use and the amount of time spent minding children as a secondary activity. For instance, including the respondent's night sleep as well as the child's sleeping time while the respondent is tending to another activity, could be considered as child service rather than home production or leisure. This is because parents must be alert and on call for their children during their night's sleep (Folbre et.al 2005) and an infant's sleep is unpredictable and intermittent (Connelly and Kimmel 2010 pp.1). However, GSS time-use cycles do not record a

[38] Any caregiving provided by the parent to their teenaged children (aged 15 years or older) is included in household production.

respondent's social contact during the activity of their night's sleep or naps and do not record a time diary for children in the household or minding a child as a secondary activity, so these types of parental duties are not included in the definition of child services. Main activities included in this category are baby care, helping/teaching reprimanding, reading/talking with child, play with children, medical/emotional care of children, and travel to/from care activities for household children.

Since parents in the sample state their major activity as either working or homemaker, I suspect a systematic difference in the time-choices of parents by gender due to the differing time constraints faced by mothers and fathers in choosing the optimal amount of time in each category. I therefore run the parental use of time models separately for mothers and for fathers.

The second model I estimate, is for young adults to assess their time-use in paid work, household production, leisure, and education activities. Three categories for young adults – paid work, household production, leisure – are aggregated in the same way as defined above for parents. The fourth category, education, I define as time spent in class or completing homework. Education was grouped into the category "other activities" for parents (See Appendix C, Table C1e through Table C1f for definitions, activity codes and selection of education related activity codes from the other activities category). I assume observed zeros in time-use variables for young adults are "false zeros" and thereby use OLS regression in SUR model estimates.

The next section describes that data. Results of the SUR models are in section 3.5.

3.4 Data

This paper uses the six time-use cycles in the General Social Survey (GSS) (years 1986, 1992, 1998, 2005, 2010 and 2015). Time-use cycles of GSS collect personal and household characteristics as well as a time diary of a respondent's activities and minutes spent on each activity over one 24-hour period. Time diaries are collected across days of the week and months of the year from one respondent per household aged 15 years or older. This work intends to assess the association between cultural factors and time-use, as mediated by gender

and place of birth, and a plausible link to young adult's time-use, which will be the focus of the empirical analysis.

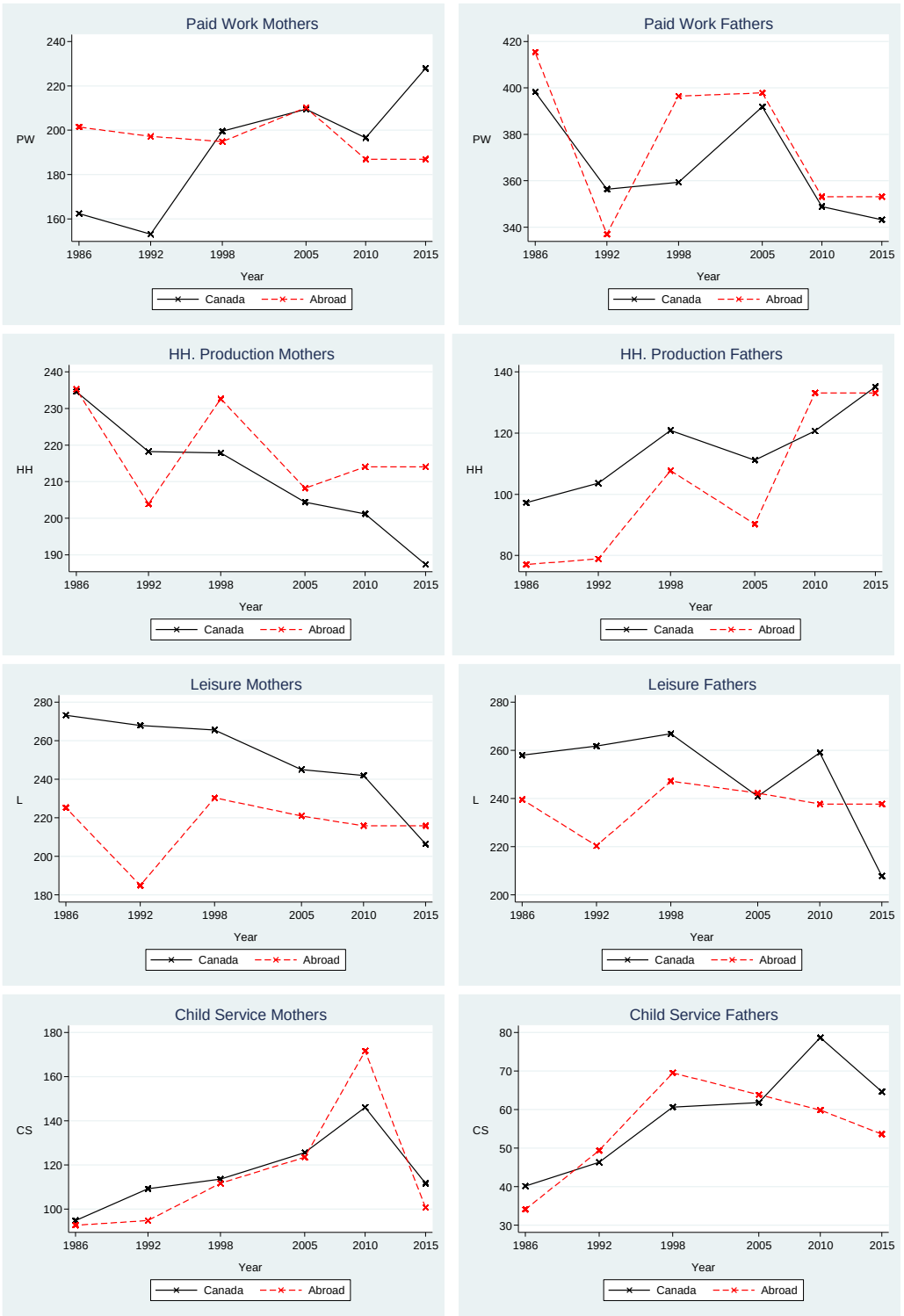
3.4.1 Parent Sample

Activities are aggregated into five categories pertinent to parental time allocation - paid work, household production, leisure, child service and other, which includes time-use activities that are too heterogeneous to aggregate and so are not informative to estimate separately. The sample includes respondents who are parents under the age of 65 years, living in a household with at least one child aged 14 years or younger and who are employed or homemakers.[39] The final sample totals 17,753 parents (10,372 mothers and 7,381 fathers).

Figure 3-1 shows the trends in time-use for the four parental time categories of this study – paid work, household production, leisure, and child services. I plot the average minutes spent daily in each category (including respondents reporting zero minutes) separately for each gender and birth place status across time-use cycles. Overall, across time-use cycles, there is a clear upward trend in average time spent in child services performed by parents of both genders and birth place which is consistent with the trend in child service found in the literature (Aguiar and Hurst, 2007 and Wei, 2020, Blau and Winkler 2018). From 2010 to 2015, mother's average child time experienced a sharp decrease which looks like the result of the spike in mothers paid work over this period. The average time spent in household production performed by fathers is increasing, whereas time spent in leisure time and paid work fluctuates.

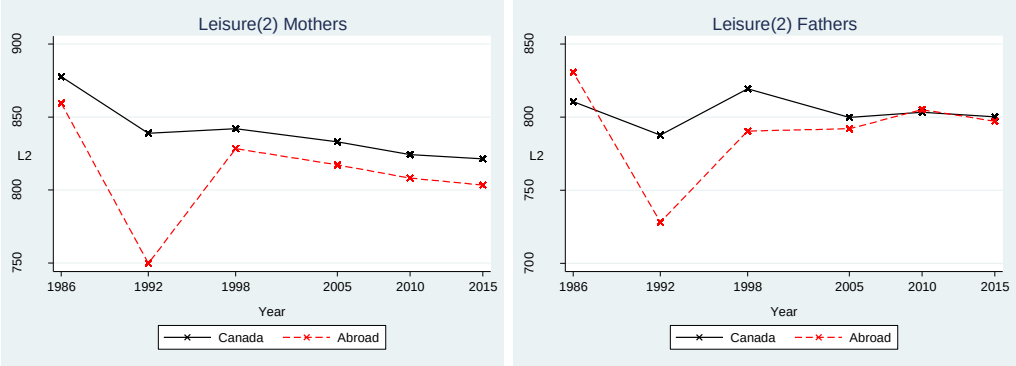
[39] Categories for self-reported main activity of the respondent in GSS time-use cycles are paid work, looking for work, student, homemaker, retired and other.

Figure 3-1: Parents Average Time-use Minutes Per Day by Year and Place of Birth.



As documented in the literature, I also find evidence that mothers' economic contribution to the family has increased over time with average time spent in leisure and household production decreased and time in paid work increased (Blau and Winkler, 2018). In Figure 3-2, I plot the average time spent in *passive leisure* (includes eating meals at home, sleeping and personal care). Overall, *passive leisure* shows a similar trend to leisure for mothers and fathers – decreasing overtime and average time spent by parents born in Canada is higher than parents born abroad.

Figure 3-2: Parents Average Passive Leisure Minutes Per Day by Year and Place of Birth.



I find significant differences when comparing average time-use of mothers and fathers by place of birth for each time-use cycle, (See Appendix C, Table C2 for mothers and Table C3 for fathers average values and results of two-group test of hypothesis by place of birth). In 1986 and 1992, the average paid working hours of mothers born abroad is approximately 35 and 45 minutes greater than that of Canadian-born mothers and these differences are significant. [40] By 1998, the average time that Canadian-born mothers spent in paid work converged to that for foreign-born mothers and stayed at a similar value through the 2000s at approximately 200 minutes per day, with the differences no longer significant. The paid working hours of fathers born abroad is higher than that of fathers born in Canada - except for 1992 - and not significant. Average time spent in household production for mothers is not

[40] This difference and subsequent convergence have been reported in the immigration literature (Benjamin and Baker 2004, Adserà and Ferrer 2014) using Canadian census data. I too find similar differences in average weekly working hours for mothers born abroad compared to mothers born in Canada using Census data for years 1986 (21.75 and 17.34) and 1992 (22.78 and 20.88).

significantly different by birth place status across all time-use cycles, expect for 2015, but for fathers the difference is significant with fathers born in Canada spending approximately 20, 25, 21 and 17 more minutes on average in years 1986, 1992, 2005 and 2015 respectively. On average, leisure time of Canadian-born mothers is higher than that of mothers born abroad and this difference is significant in every time-use cycle. However, the average leisure time of Canadian-born mothers is converging to the value observed for foreign-born mothers. It decreased from 270 minutes in 1986 to 210 minutes in 2015 while average minutes for foreign-born mothers has fluctuated at around 180 to 220 minutes. The average leisure time of fathers is higher for the Canadian born and the differences are significant for years 1992, 2010 and 2015 (with 41, 22 and 26 more minutes respectively). The most notable difference in child service by origin status is a significant difference in average values in 1992 - with Canadian-born mothers spending approximately 20 more minutes in child service than the foreign-born mothers do - and in 2010 - with mothers born abroad spending approximately 25 more minutes than mothers born in Canada do. Father involvement in average child service is trending upward across time-use cycles and comparing fathers born abroad to Canadian-born fathers, their average values fluctuate. However, the difference in father's average time is significant only in 2010 with Canadian-born fathers spending on average approximately 21 more minutes on child service.

As discussed above, the fraction of observed zeros and the nature of observing a zero in time-use variables have implications for the model choice. The average value of the household's time-use categories is shown in Table 3-1. In either case, parents spend most time on work followed by leisure, household production and child service at approximately 275, 242, 165 and 81 average minutes respectively and mothers spend less time in paid work and leisure and more time in household production and child service than fathers. Furthermore, the percentage of zero observations for paid work, household production, leisure and child services is 42% (8,043/17,753), 12.5% (2,218/17,753), 6.1% (1,088/17,753) and 33.73% (5,988/17,753) respectively and I find differences in the fraction of non-zero observations in mothers' and fathers' activities such as the fraction of participation in work is approximately

Table 3-1: Parents Average Time-use Minutes per Day (SE).

	All Parents	Mothers	Fathers
Paid Work	275.62 (2.59)	193.50 (2.97)	367.97 (4.00)
HH Production	165.20 (1.46)	211.97 (1.90)	112.59 (2.02)
Leisure	242.71 (1.67)	241.56 (2.13)	243.99 (2.63)
Child Service	81.53 (1.11)	106.98 (1.68)	52.92 (1.27)
Leisure(2)	815.27 (2.19)	829.60 (2.70)	799.17 (3.50)
Observations	17,753	10,372	7,381

44% (4,556/10,372) for mothers and approximately 70% (5,154/7,381) for fathers. The fraction of zero observations is considered in the data generating process and addressed in the results section.

In addition to time-use diaries, the GSS collects information on household and human capital characteristics which are useful determinants for parental time-use allocation. Table 3-2 shows summary statistics for the variables used in each equation in the system of parental time-use equations I estimate, as well as for the identifiers used for sample selection. Canada is a country with a large population of immigrants and the evidence suggests that cultural factors may affect time-use decisions. To capture the impact of first generation immigrants on time-use demand functions, the covariate matrix X includes an indicator for the respondent born abroad. To further disentangle cultural effects using birthplace region of origin, I define as second generation those children born in Canada to a foreign-born mother or father. Furthermore, cultural factors may intensify or attenuate with time spent in Canada and are likely unique to the source country of immigrants. Considering years since migration to Canada as a determinant of time-use demand functions captures demand for time-use conditional on length of stay, thus capturing the immigration assimilation process that is distinct from individual preferences over time-use. Hence, in addition to generation status, the

Table 3-2: All Parents Summary Statistics (SE).

All Parents Human Capital and Household Characteristics					
Born Abroad	0.23 (0.004)	Male	0.47 (0.005)	NF	0.02 (0.001)
Africa	0.05 (0.002)	Age	37.31 (0.07)	PEI	0.005 (0.0003)
Asia	0.09 (0.002)	Less HS	0.15 (0.003)	NS	0.03 (0.001)
Europe	0.03 (0.002)	HS	0.29 (0.004)	NB	0.02 (0.001)
SCA	0.02 (0.001)	College	0.29 (0.004)	QC	0.23 (0.004)
UKNA	0.03 (0.002)	Bachelor	0.20 (0.004)	ON	0.38 (0.005)
Other	0.005 (0.0006)	Graduate	0.07 (0.002)	MB	0.04 (0.001)
Canada	0.77 (0.004)	lone-parent	0.094 (0.002)	SK	0.04 (0.001)
Years Since Migration	16.22 (0.24)	Multiple generations	0.04 (0.002)	AB	0.11 (0.003)
Not Stated ysm	0.12 (.002)	Number of children	2.00 (0.01)	BC	0.12 (0.003)
Second generation	0.15 (0.003)	Age youngest	6.05 (0.04)	1986	0.14 (0.003)
Main activity works	0.75 (0.004)	Age youngest 0-4 yrs. old	0.44 (0.005)	1992	0.16 (0.003)
Main activity HH work	0.25 (0.004)	Age youngest 5-9 yrs. old	0.28 (0.004)	1998	0.17 (0.004)
		Age_youngest 10-14 yrs. old	0.27 (0.004)	2005	0.17 (0.003)
		Weekend diary day	0.28 (0.004)	2010	0.19 (0.004)
		CMA	0.60 (0.004)	2015	0.17 (0.004)
Observations			17,753		

covariate matrix X includes years since migration and years since migration squared and in a second specification, seven birth place region of origin categories (Canada, Africa, Asia, Europe, English speaking countries, South Central America and Other) take the place of the immigrant indicator. [41] I also define an indicator variable for those immigrants who do not state years since migration.[42]

Because families can have different time-use patterns on weekdays vs weekends, I control for respondents with time-diaries surveyed on Saturdays and Sundays to avoid measurement error arising from the day of the week the respondent's time-diary was collected. Since children's regular school schedule is Monday to Friday, it can be expected that parent's time spent with children surveyed on weekends will be higher than surveyed during the week. Furthermore, I could observe systemic patterns of time-use behaviour that are due to other constraints. For instance, if immigrant mothers tend to work more on jobs with a weekend schedule than Canadian-born mothers, and I observe a large difference for mother's leisure time, this variation in leisure could be explained by the subsample of mothers interviewed on weekends, where mostly immigrant mothers are working weekends.

To control for cross sectional variation, I include as covariates the sociodemographic characteristics of the household: a categorical variable for age of the youngest child (between 0-4, 5-9, or 10-14 years old), number of children, presence of a partner in the household and presence of multiple generations in the household, as well as a set of year, province and Census Metropolitan Area (CMA) controls to account for regional and temporal differences across households. To control for characteristics of the parent, I include the respondent's age, level of education and gender.

The average years since migration in my sample is 16.22, this indicates that the average time-use minutes I observe correspond to parents born abroad who, on average, have passed the entry stage of the immigration process.

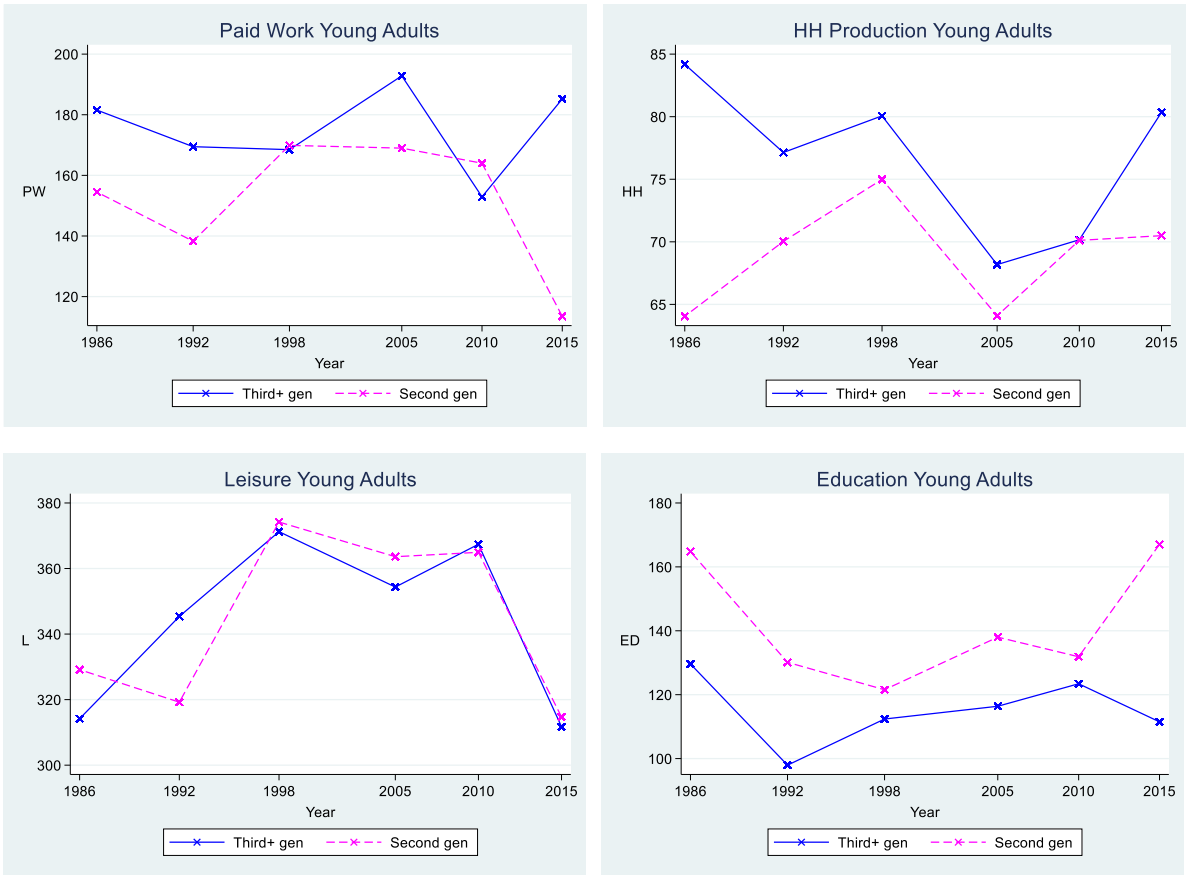
[41] English speaking countries include; United Kingdom, Ireland, North America and Australia.
[42] Respondents with a valid entry for born abroad, but not stated years since migration.

3.4.2 Young Adult Sample

Categories for young adults – paid work, household production, leisure – are aggregated in the same way as done for parents and education activities, previously defined in the category other for parents, replaces child services in the system of equations for young adults. The sample includes respondents who are ages 15-25 years and consists of 11,158 young adults.

Figure 3-3 shows the trends in average time use of young adults born in Canada by their parents' birthplace. I define as "third+ gen" those young adults with neither parent born abroad and I define as "second gen" those young adults with at least one parent born abroad

Figure 3-3: Young Adults Average Time-use Minutes Per Day by Year and Generation Status.



for a sample of 9,957 young adults (7,998 third+ and 1,959 second).[43] I plot the average time spent in paid work, household production, leisure and education activities separately for each generation status across time-use cycles. Overall, average paid work and education has fluctuated and average unpaid work – household production has decreased. Average leisure time was increasing and started decreasing in the early 2000s. Average time devoted to educational activities has remained relatively stable. These trends in time spent by young adults likely reflect the demographic trend of individuals having fewer children later in life and thus choosing less unpaid work responsibilities overtime.

The significant differences I find in average time-use of youths by generation status and across time-use cycles are overwhelmingly in paid work and education activities (See Appendix C, Table C4 for average values and results of two-group test of hypothesis by generation status). With the exception of education activities in 1998 and paid work and education activities in 2010, second generation youths spent significantly less time in paid work and more time in education activities at 27, 31, 24 and 72 less minutes in paid work and 35, 32, 22, 8 and 56 more minutes in education activities compared to third+ generation youths. Only in 1986 and 1992 I find a significant difference for second generation young adults with 20 minutes less household 26 minutes less leisure respectively.

The average values for the four categories of time use spent by young adults are shown in Table 3-3. Including zeros, young adults spend the most time in leisure, which is followed by paid work, education and household production and excluding zeros, young adults spend the most time on paid work followed by leisure, education, and household production. The percentages of zero observations in paid work, household production, leisure and education are 61% (6,825/11,158), 31.10% (3,470/11,158), 4.65% (519/11,158) and 66.88% (7,462/11,158).

[43] In Figure 3-3 and Appendix C, Table C4, I remove young adults born abroad from the sample.

Table 3-3: Young Adults Average Time-use Minutes per Day (SE).

	Young Adults
Paid Work	167.10 (3.01)
HH Production	74.46 (1.30)
Leisure	341.41 (2.73)
Education	126.98 (2.53)
Observations	11,158

Table 3-4 shows summary statistics of relevant variables used in each equation in the system of time-use equations I estimate for young adults. To control for cultural effects in time-use, I estimate the SUR model using three different specifications to identify if their mother or father was born abroad or from one of the 6 regions of origin – Africa, Asia, Europe, SCA, UKNA and other. Other variables associated with time-use considered here are gender, age, education, parents living in the household, as well as geographic location, year, and weekend day of the survey.

Table 3-4: Young Adults Summary Statistics (SE).

	Young Adults					
Mother born abroad	0.29	Male	0.51	NF	0.02
	(0.006)		(0.006)		(0.0009)
Mother born in Africa	0.03	Age	20.05	PEI	0.005
	(0.002)		(0.04)		(0.0003)
Mother born in Asia	0.11	Less HS	0.36	NS	0.03
	(0.004)		(0.006)		(0.001)
Mother born in Europe	0.07	HS	0.40	NB	0.02
	(0.003)		(0.006)		(0.001)
Mother born in SCA	0.03	College	0.14	QC	0.22
	(0.003)		(0.004)		(0.005)
Mother born in UKNA	0.03	Bachelor	0.09	ON	0.38
	(0.002)		(0.004)		(0.006)
Mother born in Other	0.03	Graduate	0.009	MB	0.04
	(0.002)		(0.001)		(0.002)
Mother born in Canada	0.71	Parents Living in Household	0.70	SK	0.04
	(0.006)		(0.005)		(0.002)
Father born abroad	0.32	Major Activity working	0.39	AB	0.11
	(0.006)		(0.006)		(0.004)
Father born in Africa	0.03	Major Activity Looking for work	0.054	BC	0.13
	(0.002)		(0.002)		(0.004)
Father born in Asia	0.12	Main activity School	0.44	1986	0.15
	(0.004)		(0.006)		(0.004)
Father born in Europe	0.08	Main activity HH work	0.05	1992	0.15
	(0.004)		(0.007)		(0.004)
Father born in SCA	0.03	Main activity Other	0.07	1998	0.16
	(0.002)		(0.003)		(0.005)
Father born in UKNA	0.03	Weekend diary day	0.28	2005	0.17
	(0.002)		(0.006)		(0.004)
Father born in Other	0.03	CMA	0.64	2010	0.18
	(0.002)		(0.006)		(0.005)
Father born in Canada	0.68	Born Abroad	0.14	2015	0.18
	(0.006)		(0.005)		(0.005)
		Second Generation	0.22		
			(0.005)		
Observations	11,158				

3.5 Results

3.5.1 Parent Results

Table 3-5 shows the results from estimating a SUR model for paid work, household production, leisure, and child service in equation (1) for all parents. For equations estimated by OLS regression, I report the beta coefficients and for equations estimated with Tobit models, I report the marginal effect. The first four columns represent the estimated coefficients for each equation in the system of equations without years since migration and the last four columns include measures for years since migration.

The most noteworthy difference in time use between parents born abroad and in Canada is time spent in leisure. Parents born abroad are spending between 24 and 28 less minutes in leisure activities daily compared to parents born in Canada – with and without controlling for years since migration. Equally significant are gender differences in each category of time-use. The coefficient for male indicates that fathers are working more, less involved in household production, spending more time in leisure and less time providing service to children living in their household compared to mothers. In particular, on a daily basis fathers are working approximately 175 more minutes, performing 105 less minutes of household production, spending 5 more minutes in leisure time (not significant) and providing 56 minutes less child service. These differences in paid work, household production and child service support the notion of traditional gender roles and quantifies its magnitude in the family environment. Since we see fathers working more while performing less household production and less child services than mothers (Table 3-5), I consider an interaction term between males and born abroad, shown in Table 3-6. I find that men born abroad perform 15 less minutes in household production and 22 more minutes in leisure than Canadian born males. They also spend 8 less minutes in child-care, but the result is not significant. This result corroborates the findings of Blau et al. 2020 about - the influence of gender and place of birth on that the persistence of traditional gender roles.

Table 3-5: All Parents SUR model (SE).*

	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg
born abroad	0.90	2.71	-28.19***	-3.92	-28.74*	7.03	-23.50**	1.88
	(6.30)	(3.81)	(4.17)	(2.89)	(13.39)	(7.68)	(8.38)	(7.65)
ysm					3.09*	-0.12	-1.90	-1.45
					(1.260)	(0.84)	(1.02)	(0.85)
sec_gen	-5.86	3.44	0.86	3.63	-5.85	3.43	0.96	3.65
	(6.46)	(4.14)	(4.59)	(2.86)	(6.45)	(4.14)	(4.59)	(2.86)
male	174.80***	-105.10***	4.86	-55.93***	174.70***	-105.00***	4.79	-55.94***
	(4.74)	(2.77)	(3.22)	(2.00)	(4.74)	(2.78)	(3.21)	(1.99)
age	0.13	1.43***	-0.59	-0.70***	0.08	1.47***	-0.71*	-0.75***
	(0.44)	(0.30)	(0.30)	(0.17)	(0.45)	(0.30)	(0.30)	(0.17)
hs	30.17***	-13.78**	-19.61***	4.00	30.25***	-13.80**	-19.78***	3.94
	(7.33)	(4.53)	(5.32)	(2.84)	(7.30)	(4.53)	(5.32)	(2.83)
college	41.29***	-10.89*	-28.22***	4.47	41.51***	-10.82*	-28.56***	4.25
	(7.55)	(4.70)	(5.55)	(3.05)	(7.52)	(4.70)	(5.55)	(3.05)
bachelor	43.50***	-23.65***	-24.55***	11.23***	44.71***	-23.85***	-24.63***	11.05**
	(7.94)	(5.05)	(5.85)	(3.38)	(7.92)	(5.05)	(5.85)	(3.41)
graduate	47.30***	-30.86***	-20.70**	8.60*	49.48***	-31.29***	-20.78**	8.39*
	(10.20)	(6.29)	(7.19)	(4.21)	(10.18)	(6.32)	(7.18)	(4.25)
multi_gen	6.99	-13.44	4.47	8.14	5.57	-13.42	5.01	8.74
	(16.66)	(8.77)	(11.67)	(10.97)	(16.60)	(8.75)	(11.58)	(11.08)
lone_parent	5.70	-14.69***	3.25	-2.84	5.14	-14.57***	3.09	-2.87
	(7.16)	(4.24)	(5.06)	(3.12)	(7.14)	(4.24)	(5.03)	(3.10)
num_child	-12.40***	11.02***	-3.25	4.65***	-12.61***	11.05***	-3.11	4.72***
	(2.83)	(1.70)	(1.82)	(1.30)	(2.81)	(1.70)	(1.82)	(1.30)
Age youngest child 0-4 yrs.	-54.46***	2.69	-37.45***	97.49***	-54.32***	2.63	-37.54***	97.48***
	(7.21)	(4.76)	(4.84)	(2.73)	(7.20)	(4.76)	(4.83)	(2.73)
Age youngest child 5-9 yrs.	-16.47*	1.49	-15.61***	35.15***	-16.42*	1.37	-15.29***	35.33***
	(6.67)	(4.23)	(4.43)	(1.98)	(6.66)	(4.23)	(4.43)	(1.97)
1992	-22.77**	-6.50	-10.71	4.77	-37.74*	1.77	-9.54	-1.41
	(8.34)	(4.97)	(5.58)	(2.90)	(15.16)	(8.63)	(9.97)	(5.76)
1998	7.98	4.68	-4.93	17.64***	-6.94	12.94	-3.89	11.35
	(8.56)	(5.09)	(5.62)	(3.22)	(15.23)	(8.62)	(9.87)	(5.91)
2005	7.12	-6.10	-20.19***	24.28***	-7.00	1.99	-19.05*	18.01**
	(7.91)	(4.68)	(5.27)	(3.00)	(14.89)	(8.30)	(9.72)	(5.80)
2010	-10.40	1.62	-15.49**	36.82***	-25.32	9.74	-13.98	30.78***
	(8.36)	(5.04)	(5.66)	(3.60)	(15.13)	(8.52)	(9.87)	(6.03)
2015	0.98	1.72	-58.71***	24.98***	-14.06	9.74	-56.96***	19.16**
	(8.94)	(5.56)	(5.76)	(3.82)	(15.40)	(8.82)	(9.84)	(6.22)
Constant		135.50***	307.70***	41.85***		125.60***	310.40***	49.93***
		(12.86)	(14.23)	(7.90)		(15.27)	(16.63)	(9.69)
Observations	17,753				17,753			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm^2, not stated ysm, cma, province, and weekend. Results available upon request.

Table 3-6: All Parents SUR model – Place of Birth and Gender Interaction (SE).*

	Paid work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg
born abroad	-28.76*	13.77	-33.17***	5.17
	(13.36)	(8.311)	(9.03)	(8.53)
male	174.70***	-101.60***	-0.19	-54.24***
	(4.75)	(3.06)	(3.59)	(2.14)
male*abroad		-15.41*	22.10**	-7.53
		(6.76)	(7.54)	(5.06)
Observations		17,753		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm, ysm^2, not stated ysm, second generation, age, education, multiple generation indicator, lone-parent, number of children, age of youngest child aged 0-4 years, 5-9 years, weekend, CMA, province, and year. Results available upon request.

Estimating the model separately by gender in Table 3-7 (mothers) and Table 3-8 (fathers), further illuminates the gender differences in leisure.[44] The result that parents born abroad spend significantly less time in leisure is driven by mothers. Table 3-7 column (3) shows that the leisure time of mothers born abroad is 40 minutes less than that of Canadian born mothers, while Table 3-8, column (3) indicates that foreign born fathers enjoy 14 minutes less in leisure relative to native-born parents. Note however, that immigrant mothers spend 15 minutes *more* per day on household production, while immigrant fathers spend 13 minutes *less* than their Canadian-born counterparts. These results support the criticism of Gronau (1977) that household production and leisure should be defined as separate areas of time-use and supports estimating parents time-use by gender as in (Kimmel and Connelly, 2007).

Figure 3-4 shows the marginal effects and confidence interval estimates for Tables 3-7 and 3-8 with and without years since migration. Controlling for years since migration (columns 5-8 and right-side plots in Figure 3-4) somewhat reduces these estimates with the exception of paid work and child services for mothers. Mothers born abroad spend approximately 40 minutes less in paid work than Canadian born mothers (column 5). Mothers born abroad spend 23 minutes less in leisure activities than Canadian-born mothers (versus 40 minutes less, reported in column 3). The (negative) coefficient for years since migration in the

[44] See Appendix C, Table C5 for OLS Regression and Tobit model estimates for mothers, and fathers.

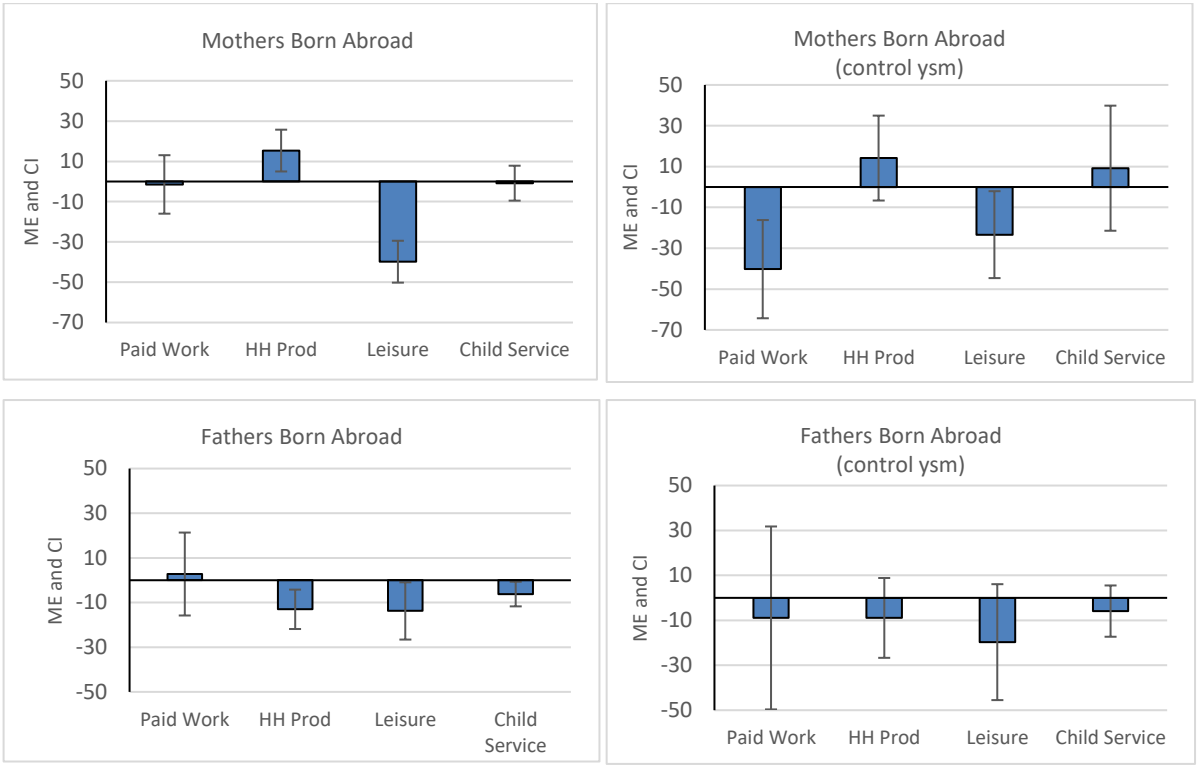
Table 3-7: Mothers SUR model (SE).*

	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg
born abroad	-1.45	15.36**	-39.81***	-0.82	-40.24*	14.17	-23.34*	9.21
	(7.41)	(5.29)	(5.30)	(4.42)	(15.63)	(10.86)	(10.61)	(12.27)
ysm					4.15*	0.83	-3.54**	-1.71
					(1.61)	(1.32)	(1.31)	(1.28)
sec_gen	-6.60	8.61	1.06	2.62	-6.63	8.60	1.18	2.62
	(7.43)	(5.63)	(6.02)	(4.31)	(7.43)	(5.63)	(6.01)	(4.31)
age	0.69	1.11**	-0.43	-1.20***	0.58	1.14**	-0.53	-1.20***
	(0.51)	(0.36)	(0.42)	(0.26)	(0.51)	(0.37)	(0.41)	(0.25)
hs	39.38***	-19.48**	-23.27***	3.72	39.86***	-19.66**	-23.49***	3.72
	(7.94)	(6.21)	(6.81)	(4.08)	(7.88)	(6.20)	(6.80)	(4.09)
college	57.69***	-21.15**	-36.24***	0.13	58.31***	-21.20**	-36.41***	0.05
	(8.34)	(6.53)	(7.09)	(4.40)	(8.28)	(6.53)	(7.10)	(4.38)
bachelor	64.95***	-40.95***	-29.83***	8.65	67.25***	-41.04***	-30.49***	8.23
	(9.24)	(7.05)	(7.62)	(5.17)	(9.20)	(7.03)	(7.64)	(5.23)
graduate	84.66***	-56.20***	-25.95**	1.13	87.38***	-56.39***	-26.51**	0.66
	(13.52)	(8.99)	(9.78)	(7.25)	(13.49)	(9.00)	(9.72)	(7.34)
multi_gen	-0.97	-8.48	10.58	27.39	-3.29	-8.86	11.42	28.14
	(18.07)	(10.95)	(14.25)	(15.84)	(17.77)	(10.91)	(14.08)	(16.07)
lone_parent	13.81*	-25.44***	2.98	-6.82	12.81	-25.48***	3.24	-6.59
	(6.92)	(4.70)	(5.55)	(3.69)	(6.90)	(4.69)	(5.51)	(3.64)
num_child	-14.19***	20.19***	-4.36	7.35***	-14.58***	20.27***	-4.12	7.40***
	(3.24)	(2.39)	(2.34)	(2.02)	(3.24)	(2.40)	(2.35)	(2.01)
age_ch 0-4	-81.68***	0.27	-28.34***	125.70***	-81.06***	0.22	-28.80***	125.60***
	(8.64)	(6.31)	(6.64)	(4.15)	(8.63)	(6.32)	(6.58)	(4.14)
age_ch 5-9	-22.59**	-0.03	-11.39*	41.52***	-22.02**	-0.09	-11.57*	41.44***
	(7.89)	(5.54)	(5.78)	(2.94)	(7.87)	(5.54)	(5.76)	(2.94)
weekend	-164.30***	41.54***	124.00***	-20.75***	-164.20***	41.55***	124.00***	-20.77***
	(4.82)	(4.28)	(4.71)	(3.01)	(4.81)	(4.28)	(4.69)	(3.01)
1992	-20.59*	-13.13	-10.75	7.39	-32.72	3.50	-9.42	-0.90
	(9.61)	(6.89)	(7.19)	(4.32)	(18.66)	(11.74)	(12.39)	(8.74)
1998	10.05	-4.48	-2.14	19.01***	-1.76	12.13	-1.02	10.60
	(9.68)	(6.78)	(7.11)	(4.37)	(18.80)	(11.61)	(12.25)	(8.78)
2005	8.31	-17.08**	-18.67**	29.39***	-2.71	-0.55	-17.70	20.89*
	(9.04)	(6.27)	(6.68)	(4.55)	(18.49)	(11.18)	(12.03)	(8.87)
2010	-3.40	-16.93*	-18.74**	45.56***	-15.56	-0.56	-17.02	37.41***
	(9.59)	(6.73)	(7.06)	(5.23)	(18.69)	(11.43)	(12.25)	(9.10)
2015	16.64	-20.21**	-54.49***	26.91***	4.21	-4.03	-52.64***	18.89*
	(10.60)	(7.57)	(7.43)	(5.82)	(19.11)	(11.94)	(12.27)	(9.53)
Constant		156.70***	317.30***	42.55***		138.60***	319.10***	51.18***
		(16.63)	(19.16)	(12.25)		(19.52)	(21.60)	(14.79)
Observations		10,372				10,372		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm^2, not stated ysm, cma, and province. Results available upon request.

Figure 3-4: Mothers and Fathers SUR Marginal Effects and Confidence Interval.



leisure equation, suggests that differences in leisure time between Canadian-born and born-abroad mothers are somewhat related to the immigration stage. The deficit in leisure time-use over time between Canadian-born and born-abroad mothers worsens through the initial years of the immigration process.

For immigrant fathers (Table 3-8) there are significant gaps in time-use relative to the native born - spending 13, 14 and 6 less minutes in household production, leisure, and child service respectively. However, such differences are no longer significant once I control for years since migration. Adding years since migration as a covariate in each equation of the SUR model for mothers or fathers does not have an impact on the rest of the variables. [45]

[45] It is noteworthy that the coefficient of years since migration in the leisure time equation is negative and significant for mothers, but close to zero and not significant for fathers.

Table 3-8: Fathers SUR model (SE).*

	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
born abroad	2.78	-13.02**	-13.75*	-6.19*	-8.93	-8.92	-19.70	-5.89
	(9.47)	(4.50)	(6.54)	(2.81)	(20.77)	(9.06)	(13.16)	(5.82)
ysm					1.27	-0.37	-0.32	-0.40
					(2.12)	(0.79)	(1.55)	(0.64)
sec_gen	-1.50	-5.18	0.39	6.18*	-1.50	-5.19	0.49	6.22*
	(9.79)	(5.00)	(6.98)	(2.92)	(9.78)	(5.00)	(6.98)	(2.92)
age	-1.22	1.75***	-0.70	-0.25	-1.24	1.76***	-0.82	-0.30
	(0.67)	(0.39)	(0.44)	(0.19)	(0.67)	(0.40)	(0.44)	(0.20)
hs	14.40	-5.03	-16.22*	9.03**	14.29	-4.99	-16.40*	8.95**
	(11.75)	(5.73)	(8.19)	(3.28)	(11.73)	(5.72)	(8.18)	(3.26)
college	9.93	5.31	-20.91*	15.53***	9.80	5.37	-21.35*	15.29***
	(11.72)	(5.81)	(8.57)	(3.38)	(11.66)	(5.79)	(8.55)	(3.39)
bachelor	1.77	0.87	-21.56*	20.29***	2.03	0.76	-21.32*	20.32***
	(11.97)	(6.12)	(8.86)	(3.57)	(11.95)	(6.10)	(8.84)	(3.58)
graduate	-6.25	-0.11	-18.52	21.14***	-5.19	-0.48	-18.00	21.31***
	(14.65)	(7.45)	(10.44)	(4.22)	(14.67)	(7.47)	(10.43)	(4.25)
multi_gen	35.11	-18.32	-5.78	-21.94**	34.84	-18.21	-5.46	-21.70**
	(23.50)	(11.27)	(19.80)	(7.07)	(23.64)	(11.30)	(19.71)	(7.07)
lone_parent	-44.50**	29.55***	1.65	19.26***	-44.57**	29.57***	1.19	18.89***
	(14.73)	(8.23)	(12.49)	(5.15)	(14.76)	(8.24)	(12.45)	(5.14)
num_child	-3.46	-0.30	-2.36	0.84	-3.49	-0.30	-2.26	0.90
	(4.43)	(1.93)	(2.87)	(1.26)	(4.38)	(1.93)	(2.86)	(1.26)
age_ch 0-4	-17.90	9.46	-47.08***	66.28***	-17.88	9.46	-46.93***	66.26***
	(10.46)	(5.86)	(7.10)	(2.81)	(10.45)	(5.84)	(7.10)	(2.80)
age_ch 5-9	-10.73	3.60	-18.61**	30.60***	-10.76	3.60	-18.10**	30.82***
	(10.06)	(5.28)	(6.83)	(1.94)	(10.04)	(5.27)	(6.83)	(1.90)
weekend	-342.30***	73.45***	170.50***	9.08***	-342.30***	73.46***	170.10***	8.96***
	(7.34)	(4.54)	(6.09)	(2.52)	(7.35)	(4.55)	(6.08)	(2.50)
1992	-23.98	3.30	-10.51	2.34	-47.06*	9.91	-8.63	3.14
	(12.92)	(6.21)	(8.61)	(3.21)	(22.57)	(10.46)	(15.60)	(6.39)
1998	9.33	20.18**	-9.38	14.66***	-13.83	26.88*	-7.66	15.34*
	(13.36)	(6.50)	(8.77)	(3.79)	(22.42)	(10.69)	(15.51)	(6.68)
2005	17.23	8.21	-21.14**	16.49***	-5.52	14.69	-18.99	17.32**
	(12.14)	(5.99)	(8.20)	(3.21)	(21.68)	(10.25)	(15.29)	(6.41)
2010	-12.95	22.72***	-12.27	24.74***	-36.02	29.37**	-9.99	25.73***
	(12.92)	(6.51)	(8.94)	(3.84)	(22.28)	(10.70)	(15.53)	(6.79)
2015	-13.39	26.00***	-64.21***	18.79***	-36.35	32.65**	-61.74***	19.92**
	(13.53)	(6.94)	(8.87)	(3.79)	(22.58)	(10.93)	(15.45)	(6.73)
Constant	521.60***		300.50***		546.50***		302.40***	
	(30.80)		(21.69)		(37.35)		(25.71)	
Observations	7.381				7.381			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm^2, not stated ysm, cma, and province. Results available upon request.

As suspected, the number of children does not impact the amount of household production or child service for fathers, but for mothers, an increase in the number of children is associated with 14 less minutes of paid work, 20 more minutes of household production and 4 less minutes of leisure and 7 more minutes of child service (this one not significant). Further, as the age of the youngest child increases, mothers and fathers spend more time in paid work and leisure and less time in household production and child service. For instance, mothers with their youngest child 0-4 years old spend 28 less minutes in leisure time than mothers with their youngest child 10-14 yrs. old. Further, lone mothers spend 14 more minutes on paid work and 25 less minutes on household production daily and conversely, lone fathers spend approximately 45 less minutes in paid work, 30 more minutes in household production and 20 more minutes in child service. Gender norms do not appear to persist in lone parent households headed by men – lone fathers spend their time akin to non-lone mothers rather than non-lone fathers or lone mothers.

Education plays a role in the time-use categories of both mothers and fathers. An education gradient is apparent with highly educated mothers spending more time in paid work and less time in household production and leisure, whereas mothers with less than a high school diploma spend less time in paid work and more time in household production and leisure. For instance, in relation to mothers with less than a high school diploma, mothers with a graduate degree spend 85 more minutes in paid work, 56 minutes less in household production and 26 less minutes in leisure whereas mothers with a high school education spend 40 more minutes working, 20 more minutes in household production and 23 less minutes in leisure. The difference in child service is close to zero. An education gradient in father's child service is apparent with higher education levels associated with more time spent with children. That is, fathers with a high school diploma, college, bachelor, or graduate level of education spend 9, 15, 20 and 21 more minutes with their children than fathers with less than a high school diploma. These results are highly significant and it's noteworthy that the largest increase in time spent on child service is from high school to college education and the magnitude of the difference with respect to fathers with less than a high school diploma begins to diminish thereafter.

The education gradient I find concurs with empirical literature on time spent with children. However, it contradicts economic theory on the demand for normal goods and has further implications on children's outcome as adults. Since highly educated parents incur a higher opportunity cost when spending time with their children, according to economic principles, should choose less time with their children with respect to the time spent by lower-educated parents. The findings here suggest that child services can be re-defined as a 'luxury' good whereby higher-income parents obtain extra time for children by purchasing market substitutes for other household tasks (Guyran et al. 2008, Ramey and Ramey 2010, Lunberg and Pollack 2014 as cited in Blau and Winkler 2018). As Blau and Winkler 2018 point out, the extent to which low-educated women lack the flexibility to change work schedules and spend more time with children in comparison to highly-educated women and this can lead to potential inequality in economic outcomes like education in the next generation.

Gender differences in child service play a significant association on weekends with fathers spending 9 more minutes and women spending 20 less minutes taking care of their children. The time trend in child service, shows a significant increase in time devoted to child services for both mothers and fathers. Mothers spend 19 more minutes and fathers spend 20 more minutes per day in 2015 than in 1986.

Given the negative association between leisure and immigrant status for both mothers and fathers, I further categorize the variable for respondent's birthplace into region of origin and re-estimate the SUR model to identify differences by broad area of origin. Results are shown in in the top panel for mothers and bottom panel for fathers in Table 3-9. I find that the leisure time for mothers born in Africa, Asia and Europe and SCA is significantly less at 50, 38, 51 and 43 minutes less, respectively, than Canadian-born mothers. For fathers, I find that only those born in Asia spend significantly less time in leisure at approximately 29 less minutes daily. Adding years since migration as a covariate in the last four columns of Table 3-9 continues to produce a negative association between leisure time and region of origin for mothers and fathers. The leisure time of mothers born in Africa and Europe shrinks in magnitude by approximately twenty minutes, from around fifty minutes less to thirty minutes less daily compared to Canadian born parents but is insignificant. For mothers born in Asia

Table 3-9: Mothers and Fathers SUR Model – Region of Origin (SE).*

Mothers

	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
Africa	23.87	3.53	-49.11***	-4.29	-16.70	1.86	-28.80*	5.88
	(14.49)	(8.36)	(8.98)	(7.23)	(19.43)	(11.95)	(12.86)	(12.44)
Asia	-9.52	18.17*	-37.34***	-2.16	-52.15**	19.43	-20.62	7.71
	(11.69)	(8.79)	(8.42)	(7.76)	(17.49)	(14.03)	(12.58)	(15.77)
Europe	11.71	24.07*	-50.39***	-5.21	-30.85	23.16	-30.53*	5.41
	(16.01)	(12.07)	(9.66)	(7.02)	(20.90)	(15.51)	(13.64)	(12.96)
SCA	6.75	8.69	-42.87**	0.06	-31.69	6.45	-26.25	10.67
	(19.48)	(14.24)	(13.59)	(12.00)	(22.66)	(16.61)	(16.19)	(15.41)
UKNA	-36.06**	24.23*	-6.61	10.67	-76.09***	29.58*	6.50	18.81
	(13.48)	(11.41)	(11.77)	(9.36)	(17.62)	(15.07)	(14.95)	(14.90)
Other	-33.19	-8.42	-108.10**	15.92	-61.02	-16.02	-94.24**	27.86
	(39.15)	(32.08)	(34.55)	(16.77)	(39.01)	(33.42)	(35.33)	(19.50)
YSM	No	no	no	no	yes	yes	yes	yes
Observations	10,732				10,732			

Fathers

	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
Africa	4.67	-25.25***	-14.04	1.62	-8.30	-21.29*	-17.59	4.04
	(17.96)	(7.00)	(11.49)	(5.14)	(25.34)	(9.89)	(16.23)	(7.51)
Asia	15.38	-18.91**	-28.82**	-9.34*	0.51	-14.05	-34.73*	-7.95
	(13.57)	(6.14)	(9.10)	(4.47)	(24.14)	(9.83)	(15.66)	(7.22)
Europe	1.09	-4.21	-1.11	-7.86	-13.52	0.86	-7.21	-6.39
	(20.00)	(9.87)	(15.11)	(5.87)	(27.15)	(13.04)	(18.28)	(7.36)
SCA	21.85	4.60	-19.59	-31.11***	11.75	8.11	-23.65	-29.81***
	(24.41)	(13.35)	(18.83)	(4.41)	(29.50)	(15.98)	(21.26)	(5.74)
UKNA	-48.24**	4.70	21.59	11.62	-67.91**	11.88	12.23	11.49
	(17.63)	(9.57)	(15.43)	(6.24)	(26.11)	(13.58)	(18.97)	(8.60)
Other	20.89	-25.05	-28.41	-4.89	20.37	-24.45	-34.29	-4.75
	(46.78)	(25.77)	(22.20)	(10.18)	(50.97)	(26.67)	(24.95)	(11.35)
YSM	No	no	no	no	yes	yes	yes	yes
Observations	7,831				7,831			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Columns (1) –(4) covariates; sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, Age_ch 5-9, weekend, CMA, province, and year and columns (5)-(8) additional covariates; ysm, ysm^2, nsysm. Results available upon request.

and SCA, adding years since migration similarly reduces the coefficient from approximately 38 to 21 less minutes and from 43 to 27 less minutes respectively, compared to Canadian born mothers, remaining statistically significant. For fathers, the negative association between place of birth and leisure time changes somewhat but continues being statistically insignificant except for the magnitude for Asian fathers which reduces from approximately 29 to 35 minutes less[46].

3.5.1.1 Alternative Definition of Leisure

As noted above, the time children spend sleeping and the time parents spend sleeping with a child in the house, could be considered into the definition of child service (Kimmel and Connelly, 2007 and Folbre et.al, 2005). However, the GSS does not collect the time that children spend sleeping or the time a parent sleeps in the company of their child, so this alternate definition of child service cannot be used in this paper. I expand the original definition in this paper to include the respondent's non-active leisure with time spent sleeping, eating meals at home and for personal care and re-estimate the SUR model in Table 3-10. The negative and significant association for the leisure time of mothers born in Africa, Asia, Europe and SCA persists in the specification without years since migration, however after controlling for years since migration, the negative relationship is not as intense as that found in Table 3-9 with the exception of SCA parents still spending 27 minutes less and all become insignificant. For fathers, this broad definition of leisure time wipes out the previous result of Asian fathers spending significantly less time in leisure than Canadian born fathers.

3.5.1.2 Household Income

Including household income as a covariate in time-use demand functions can point to trade-offs in the number of minutes used in pertinent parental time-use categories. Gronau (1977) finds that increases in household income will increase leisure, reduce work in the market, and have no effect on household production. Using GSS 1986-2015, I define a variable to

[46] I re-estimate the SUR model for fathers using OLS for child service and find that the magnitude of marginal effects decreases and remain insignificant with the exception of SCA which remains significant and the magnitude decreased by 10 minutes (See Table A6).

Table 3-10: Mothers and Fathers SUR Model – Passive Leisure (SE).*

Mothers

	Paid Work Tobit	HH Prod Reg	Leisure(2) Reg	Child Service Reg	Paid Work Reg	HH Prod Tobit	Leisure(2) Reg	Child Service Tobit
Africa	17.89	3.53	-32.50**	-4.39	-20.17	1.86	-4.12	5.77
	(14.23)	(8.36)	(11.60)	(7.23)	(19.06)	(11.95)	(17.46)	(12.44)
Asia	-13.21	18.19*	-31.59*	-2.26	-53.56**	19.45	-5.88	7.61
	(11.80)	(8.78)	(12.73)	(7.77)	(17.17)	(14.03)	(17.60)	(15.78)
Europe	7.16	24.09*	-30.91*	-5.30	-32.83	23.17	-2.12	5.32
	(15.90)	(12.07)	(12.85)	(7.03)	(20.71)	(15.51)	(18.07)	(12.96)
SCA	6.37	8.73	-54.18**	-0.02	-30.31	6.48	-27.75	10.58
	(19.17)	(14.23)	(16.57)	(12.00)	(22.56)	(16.60)	(20.75)	(15.42)
UKNA	-34.25**	24.23*	-8.25	10.57	-72.94***	29.57*	12.79	18.71
	(13.24)	(11.41)	(14.30)	(9.37)	(17.51)	(15.07)	(19.23)	(14.91)
Other	-46.47	-8.41	-140.50	15.82	-71.57	-16.03	-114.40	27.76
	(47.39)	(32.08)	(79.15)	(16.77)	(45.95)	(33.42)	(79.74)	(19.51)
YSM	No	no	no	no	yes	yes	yes	yes
Observations	10,732				10,732			

Fathers

	Paid Work Reg	HH Prod Tobit	Leisure(2) Reg	Child Service Tobit	Paid Work Reg	HH Prod Tobit	Leisure(2) Reg	Child Service Tobit
Africa	4.98	-25.53***	6.14	1.49	-8.00	-20.68*	-3.86	3.95
	(17.96)	(7.07)	(16.78)	(5.14)	(25.34)	(9.86)	(24.78)	(7.49)
Asia	15.70	-18.88**	-19.63	-9.51*	0.80	-12.93	-31.82	-8.03
	(13.58)	(6.17)	(14.59)	(4.45)	(24.14)	(9.84)	(25.97)	(7.18)
Europe	1.38	-4.33	8.08	-8.05	-13.25	1.67	-3.99	-6.61
	(20.01)	(9.86)	(20.42)	(5.83)	(27.16)	(13.09)	(27.24)	(7.31)
SCA	22.14	5.10	-5.67	-30.55***	12.02	9.63	-13.40	-29.24***
	(24.42)	(13.26)	(26.17)	(4.40)	(29.51)	(15.88)	(31.80)	(5.78)
UKNA	-47.95**	4.39	42.11*	11.73	-67.65**	12.63	24.62	11.72
	(17.64)	(9.58)	(17.86)	(6.28)	(26.11)	(13.63)	(26.83)	(8.63)
Other	21.20	-25.86	17.84	-6.37	20.66	-23.89	17.91	-6.09
	(46.78)	(25.89)	(29.71)	(10.19)	(50.97)	(26.77)	(34.02)	(11.27)
YSM	No	no	no	no	yes	yes	yes	yes
Observations	7,831				7,831			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates columns (1) –(4) sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, age_ch 5-9, weekend, CMA, province, and year and columns (5)-(8) additional ysm, ysm^2, nsysm. Results available upon request.

capture the heterogeneous effects of household income – to identify whether the respondent lives in a household with income below the Low Income Cut-off (LICO) for their city size and re-estimate a SUR model. Sample sizes in this exercise drop to 9,032 mothers and 7,830 fathers, since not all households report household income. Results are presented in Table 3-11. I find that for mothers, living in households below the poverty line is negatively related to spending time in paid work and positively related to spending time in household production, leisure, and child service. For fathers, the only significant effect is the negative correlation between living in a household below the poverty line and spending less time in paid work. Furthermore, for mothers, an interaction term of immigrant status and living below LICO in Table 3-12 reveals that immigrant mothers living under the poverty line experience 25 less minutes of leisure than Canadian mothers living under the poverty line.

Table 3-11: Mothers and Fathers SUR model – Control for LICO (SE).*

	Mothers				***Fathers***			
	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
Africa	5.00	-17.96	-25.10	-1.39	-6.40	-18.95	-21.79	10.31
	(22.77)	(14.26)	(14.99)	(12.41)	(28.33)	(11.22)	(18.25)	(8.72)
Asia	-35.72	7.72	-10.09	-14.66	9.37	-8.74	-35.33*	-2.58
	(20.01)	(16.46)	(14.65)	(11.55)	(24.90)	(11.23)	(16.79)	(8.46)
Europe	-11.73	5.14	-25.62	-4.32	-8.39	-0.09	-2.75	-1.29
	(24.55)	(17.77)	(15.38)	(11.83)	(28.67)	(14.36)	(20.34)	(8.28)
SCA	-12.18	-25.42	-21.70	4.83	34.42	1.82	-34.73	-28.19***
	(26.75)	(18.43)	(19.14)	(16.18)	(31.81)	(15.25)	(22.70)	(6.31)
UKNA	-48.02*	16.34	7.64	-0.52	-56.31*	16.13	8.16	13.70
	(21.47)	(17.55)	(16.86)	(12.61)	(27.77)	(15.41)	(20.43)	(9.27)
Other	-80.47	14.82	-67.21	12.63	-22.34	-10.55	-26.25	17.80
	(45.79)	(34.31)	(38.54)	(23.16)	(67.79)	(45.62)	(34.78)	(18.17)
underLICO	-66.48***	29.70***	33.45***	11.06**	-32.09*	-1.02	9.22	3.01
	(7.47)	(5.80)	(6.11)	(4.01)	(13.24)	(5.92)	(8.67)	(3.62)
YSM	yes	yes	yes	yes	yes	yes	yes	yes
Observations	8,605				6,311			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates columns (1) –(4) sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, age_ch 5-9, weekend, CMA, province, and year and columns (5)-(8) additional ysm, ysm^2, nsysm. Results available upon request.

Table 3-12: Mothers and Fathers SUR model – LICO Interaction (SE).*

	Mothers				Fathers			
	Paid Work Tobit	HH Prod Reg	Leisure Reg	Child Service Reg	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
born abroad	-18.83	-5.19	-5.51	-9.38	-5.58	-9.33	-15.40	-6.26
	(17.53)	(13.04)	(13.30)	(10.31)	(19.83)	(8.69)	(13.15)	(5.69)
underLICO	-64.04***	26.47***	39.10***	7.07	-50.70***	3.14	14.75	-1.51
	(7.10)	(6.00)	(6.87)	(4.34)	(12.54)	(5.35)	(8.48)	(2.90)
underLICO* born abroad		7.58	-24.94*	7.13	14.10		-24.38	
		(12.65)	(12.32)	(9.33)	(23.46)		(15.58)	
YSM	yes	yes	yes	yes	yes	yes	yes	yes
Observations	8,605				6,311			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm, ysm^2, nsysm, sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, age_ch 5-9, weekend, CMA, province, and year. Results available upon request.

3.5.2 Young Adult Results

To assess differences in time-use of second-generation Canadian children, I estimate the SUR model for the minutes young adults aged 15-25 years old spend on paid work, household production, leisure, and education activities in Table 3-13 and show the marginal effects and confidence interval estimates for second-generation immigrants in Figure 3-5[47].

The estimates reveal that second-generation young adults spend less time in paid work, household production and leisure and more time on education activities compared to young adults with Canadian born parents. Time spent in paid work and education activities are statistically significant and second generation young adults spend 20 less minutes in paid work and 19 more minutes in education activities per day. Furthermore, it is noteworthy that I find evidence of a difference in time-use of young adult males spending 26 more minutes in paid work, 35 less minutes in household production, 60 more minutes in leisure and 13 less

[47] See Appendix C, Table C6 for OLS Regression model estimates for young adults.

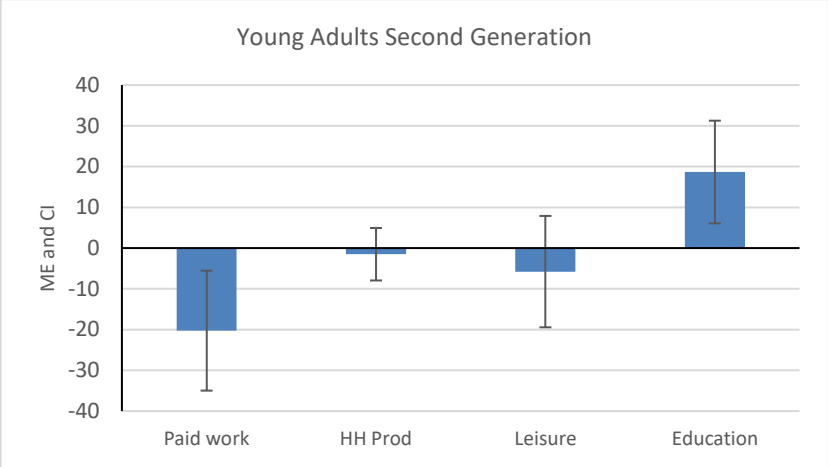
Table 3-13: Young Adults SUR Model (SE).*

	Paid work Reg	HH Prod Reg	Leisure Reg	Education Reg
second generation	-20.26**	-1.51	-5.78	18.66**
	(7.51)	(3.29)	(6.97)	(6.43)
born abroad	-32.20***	1.09	-17.07*	36.79***
	(9.39)	(4.33)	(8.58)	(8.75)
male	25.86***	-35.29***	60.07***	-13.14**
	(5.66)	(2.54)	(5.14)	(4.79)
age	24.27***	4.25***	-5.34***	-18.37***
	(1.03)	(0.46)	(0.95)	(0.87)
parents in HH	5.10	-32.18***	25.16***	16.92**
	(7.83)	(3.40)	(6.49)	(5.97)
CMA	-13.50*	-8.36**	-8.44	36.40***
	(6.25)	(2.77)	(5.53)	(4.94)
weekend	-85.50***	20.45***	130.50***	-101.60***
	(5.96)	(2.95)	(5.99)	(4.80)
1992	0.86	-2.26	21.88**	-46.99***
	(9.84)	(3.99)	(8.28)	(8.22)
1998	-1.29	5.13	54.17***	-34.99***
	(10.17)	(4.29)	(8.74)	(8.77)
2005	15.27	-3.70	36.53***	-27.44***
	(9.09)	(3.69)	(7.58)	(7.78)
2010	-15.22	1.28	48.42***	-30.97***
	(10.28)	(4.30)	(8.95)	(8.66)
2015	-12.23	7.66	-5.73	-23.32*
	(10.23)	(4.77)	(9.35)	(9.40)
Province	yes	yes	yes	yes
Constant	-296.19	27.74	353.79	510.18
	(25.49)	(11.45)	(23.86)	(22.28)
Observations	11,158			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates province. Results available upon request

Figure 3-5: Young Adults SUR Marginal Effects and Confidence Interval.



minutes on their education activities. Given this evidence of young adult males and since the economic outcomes and intergenerational mobility of second generation Canadian immigrant children depend on gender (Aydemir et al. 2009), I re-estimate the SUR model to include an interaction term for generation status and gender in Table 3-14.[48] The lack of paid work time spent by second generation young adults (20.26 minutes less in Table 3-13) was driven by females as the estimate remains relatively unchanged at around 19 minutes less but becomes insignificant. The lesser time spent in household production was driven by males as the estimate changes sign to positive but remains statistically insignificant. Education activities performed by second generation youths of both genders remains positive and loses significance and the result for leisure time remains relatively unchanged. Overall, the time spent by second generation young adults shows evidence of variation by gender roles with second generation females working less and second-generation males spending less time in household production than second generation females. The difference in average minutes spent by second generation Canadian immigrant young adults compared to their counterparts with Canadian born parents is suggestive of differential behaviours towards human capital investment, non-wage-earning activities and work around the household, but the results are not precisely estimated.

[48] Estimating the model for young adults separately by gender is not possible as the sample size is too small.

Table 3-14: Young Adults SUR Model – Generation Status and Gender interaction (SE).*

	Paid work Reg	HH Prod Reg	Leisure Reg	Education Reg
second generation	-18.79	2.232	-2.797	13.14
	(9.635)	(5.145)	(8.694)	(8.699)
male*second generation	-2.868	-7.286	-5.805	10.74
	(13.76)	(6.079)	(12.86)	(11.96)
born abroad	-32.21***	1.068	-17.08*	36.82***
	(9.389)	(4.327)	(8.577)	(8.751)
male	26.49***	-33.68***	61.35***	-15.52**
	(6.332)	(2.847)	(5.728)	(5.295)
Observations		11,158		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates born abroad, male, age, parent HH, weekend, CMA, province, and year.
Results available upon request.

As is the case for parents, there is heterogeneity in the result for young adults by parent's birthplace region of origin. In Table 3-15, I estimate the SUR model separately with a set of controls for mother's and a set of controls for father's birthplace region of origin. I find that young adults with Asian mothers or fathers are spending 41 and 31 less minutes in paid work and 54 and 58 more minutes on educational activities respectively and the result is highly significant. Likewise, for young adults with European mothers or fathers - 41 and 16 less minutes in paid work and 27 and 23 more minutes on education activities however the result for European fathers and paid work is not significant. For leisure time, young adults with Asian mothers or fathers and European mothers or fathers enjoy 15, 21, 24 and 16 less minutes in leisure respectively however, the results for young adults with an Asian mother or a European father are not significant.

As mentioned previously, aspirations and expectations can vary by culture and time-use patterns of parents influence time allocation of their children. Time-use data is one way to expose the difference in human capital generating activities experienced by Asian and European newcomers and their children.

Table 3-15: Young Adults SUR Model – Region of Origin (SE).*

	Paid Work	HH Prod	Leisure	Education		Paid Work	HH Prod	Leisure	Education
	Reg	Reg	Reg	Reg		Reg	Reg	Reg	Reg
m_Africa	-13.78	0.28	-66.56***	31.05	f_Africa	-10.92	2.09	-65.59***	41.65*
	(20.67)	(9.52)	(18.32)	(20.86)		(19.51)	(9.89)	(18.43)	(20.66)
m_Asia	-41.00***	-3.94	-15.34	54.22***	f_Asia	-30.87**	-7.40	-21.11*	48.26***
	(11.20)	(4.91)	(10.93)	(11.08)		(10.99)	(4.51)	(10.56)	(10.50)
m_Europe	-26.42*	0.24	-24.82*	27.60*	f_Europe	-16.69	-1.07	-15.64	23.66*
	(12.64)	(6.09)	(11.42)	(11.47)		(12.04)	(5.45)	(11.29)	(10.64)
m_SCA	-23.43	-0.70	4.12	14.37	f_SCA	-34.38	-1.22	-0.43	16.82
	(19.52)	(8.57)	(17.96)	(17.50)		(17.83)	(7.97)	(16.75)	(17.85)
m_UKNA	-20.14	2.36	39.34*	-14.61	f_UKNA	-14.62	-0.03	9.44	0.77
	(16.33)	(6.06)	(15.48)	(12.38)		(15.17)	(5.86)	(14.65)	(12.20)
m_Other	17.24	15.67	-31.38	-20.38	f_Other	25.54	9.10	-13.17	-22.73
	(21.10)	(9.68)	(17.17)	(13.16)		(19.08)	(8.46)	(15.71)	(11.98)
Observations	11,158				Observations	11,158			

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates born abroad, male, age, parentHH, weekend, CMA, prov., and year. Results available upon request.

3.5.3 Alternate Specification of Estimation Procedures

Classifying observed zeros in time-use data as "false zeros" prescribes a given regression model to estimate the determinants of the demand function. For fathers, I assumed that an observed zero in child service was a "true zero" and thereby estimated father's child service as a Tobit model in the SUR model estimates. To test significance of this assumption, I re-estimate the SUR model with child service as a regression model (See Appendix C, Table C7). Overall, the magnitude of the OLS coefficients are smaller than previously and the result of SCA fathers remains significant. The comparison of these results are consistent with the construction of OLS and Tobit because regression handles observations with zero minutes as equal to nonzero minutes whereas the Tobit model recognizes zero observations and adjusts the likelihood function accordingly and therefore, by construction the conditional average in a OLS model is lower.

3.6 Conclusion

Outcomes of second generation Canadian immigrant children are a current topic in immigration literature. Mothers' and fathers' adjustments to labour market participation decisions and behaviour towards the care of the home and family are one way to understand the success of economic integration. Since Canada has a large representation of parents that are born abroad and raising children, differences in time-use at the time of migration and with time in Canada are of interest to researchers.

Estimating a SUR model for paid work, household production, leisure, and child service, I find a significant difference in gender across all areas of time-use as well as strong differences between leisure and paid work time and respondent's place of birth for mothers. Extending the model with years since migration of Canadians born abroad explains the difference between leisure time and mothers born in Asian and SCA entirely, and partly explains the difference between leisure time and mothers born in Africa and Europe. The lack of leisure time spent by mothers born abroad compared to mothers born in Canada deepens with time spent in Canada. This finding does not support the integration of Canadian immigrants in economic terms and exposes the difficult transition in social terms and overall well-being. The lack of leisure for immigrant mothers I observe, does not impact time spent with their children as there is no significant difference between immigrant and non-immigrant Canadian mothers time spent with children.

Estimating the model with education activities in the system of time-use equations for young adults, I find significant heterogeneity in this result by parent's birthplace. Young adults with European mothers or Asian mother or father work less and complete more education activities daily.

Immigrant source regions in Canada had changed in the 1980s from predominantly European countries to regions more distant culturally such as Asia, Africa, and South America. As a result, the cultural mix of second-generation immigrant children, in particular from Asian descent, has increased, which further adds to interest in contemporary research on time-use behaviour of parents and young adults. This suggests that countries with large immigrant populations, such as Canada, may show important heterogeneous effects in terms of time-use

allocation that will affect households' responses to policies aimed at the well-being of families. Policies that affect the incentives to participate in these activities, such as day care policies or family allowances, have the potential to disproportionally affect the immigrant population, which is more represented at the bottom of the income distribution.

The study is consistent with a large literature illustrating the gender gap and the motherhood penalty and the double penalty often experienced by immigrant women by showing the time gaps in paid work and leisure experienced by mothers in general and immigrant mothers specifically. Since a mother's time away from paid work to spend on leisure or child services costs her hourly wage forgone plus the cost of either child care or the cost for payment to place the child in an extracurricular activity, this study would benefit from access to information on a respondent's wage and price of child care or extracurricular activities to assess the true cost of a mother's time.

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Appendix A

Table A1: GSS time-use activity codes for Total Child Care and Education.

Care Activity	
DUR200	**Baby care/child care** Examples: nursing, taking out in stroller, microwaving baby's bottle
DUR210	**Child Care** Examples: putting children to bed, getting ready for school, bathing
DUR240	**Play with children** Examples: entertaining, playing games, going biking
DUR250	**Medical care and emotional care** Examples: bandaging cut, giving medication, calming and talking to autistic child
DUR291	**Travel to/from personal care activities** Examples: driving to shows, schools and babysitters
Education Activity	
DUR220	**Helping/teaching/reprimanding with children** Examples: revising homework, quizzing before a test,
DUR230	**Reading, talking/conversation with children** Examples: read to, listen to read aloud, hear about the HH child day
DUR281	**Visiting child care/school establishments, communication for child care/school activities, other education help and other non-educational help** Examples: meeting with child's tutor, attending parent teacher interviews, reviewing school report card

Table A2: GSS time-use activity codes for Total School and Homework.

Class Activity	
DUR500	**Full Time Classes** Examples: writing exam, consulting with teacher on term paper and attending class
DUR511	**Other Classes part-time** Examples: audit a course as a part-time student and taking courses to prepare for university or college
DUR512	**Credit Courses on television** Examples: viewed educational program on TV for a credit course through university television
Homework Activity	
DUR530	**Homework** Examples: attending a group study, non-paid research in the library and studying for exams

Table A3: Determinants of Total childcare Minutes Per Day – Alternate methods (SE).

	Mothers			Fathers		
	Tobit	**Reg**	**Reg>0**	**Tobit**	**Reg**	**Reg>0**
UKNA	4.570	6.414	15.42	4.268	-2.698	-17.00
	(11.16)	(17.37)	(20.77)	(6.989)	(10.40)	(14.04)
SCA	6.609	9.996	19.66	-16.59*	-29.77**	-29.72
	(10.73)	(16.69)	(19.79)	(7.327)	(10.37)	(15.81)
Europe	-2.988	-0.828	9.721	1.698	2.056	7.365
	(9.587)	(14.84)	(17.59)	(7.071)	(11.52)	(16.31)
Africa	8.786	10.44	16.91	-11.63	-16.70	-19.63
	(11.09)	(17.24)	(19.18)	(8.613)	(12.69)	(15.08)
Asia	12.20	18.69	30.50	-5.400	-9.504	-5.625
	(10.59)	(17.31)	(20.35)	(5.797)	(8.986)	(12.91)
Other	16.27	23.94	40.44	4.752	3.699	15.53
	(14.17)	(20.86)	(25.22)	(11.15)	(14.41)	(22.05)
workhrs	-4.485***	-6.952***	-8.640***	-2.344***	-3.835***	-6.049***
	(0.230)	(0.296)	(0.355)	(0.190)	(0.279)	(0.448)
Family Structure	Yes	Yes	Yes	Yes	Yes	Yes
Human Capital	Yes	Yes	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant		102.5***	112.9***		54.45***	89.48***
		(10.33)	(11.95)		(8.691)	(13.12)
Observations	9770	9770	7799	6859	6859	3829

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Family Structure includes a binary variable indicating if the parent is a lone parent, if there are multiple generations in the household and if the youngest child of the household is less than four years old and a continuous variable for number of children in the household.

Human Capital includes respondent's age, education in levels, years since migration, years since migration squared and a binary variable to indicate if the respondent does not state their years since migration.

Table A4: Determinants of Education Minutes Per Day – Alternate method (SE).

	Mothers			Fathers		
	Tobit	**Reg**	**Reg>0**	**Tobit**	**Reg**	**Reg>0**
UKNA	4.136	6.695	10.76	3.865	4.010	3.979
	(3.359)	(4.738)	(9.816)	(3.892)	(4.012)	(17.90)
SCA	1.711	7.145	21.07*	5.852	8.187	27.90
	(3.462)	(4.473)	(8.238)	(4.313)	(5.767)	(25.49)
Europe	3.006	6.081	10.21	5.814	8.897	33.03
	(3.015)	(4.107)	(8.340)	(4.507)	(7.981)	(31.83)
Africa	4.084	7.746	14.98	7.325	12.33	40.31
	(3.810)	(5.001)	(10.61)	(5.154)	(8.005)	(27.41)
Asia	5.301	12.48**	31.41***	7.397*	10.05	33.74
	(2.727)	(4.015)	(7.987)	(3.356)	(5.260)	(23.58)
Other	11.48*	17.72*	25.99	12.44*	13.77	25.48
	(5.102)	(7.554)	(16.36)	(5.822)	(7.347)	(30.29)
workhrs	-0.527***	-0.886***	-2.243***	-0.250*	-0.286**	-1.012**
	(0.0970)	(0.113)	(0.272)	(0.0976)	(0.102)	(0.390)
Family Structure	Yes	Yes	Yes	Yes	Yes	Yes
Human Capital	Yes	Yes	Yes	Yes	Yes	Yes
Year Controls	Yes	Yes	Yes	Yes	Yes	Yes
Constant		6.941	52.63***		1.470	5.120
		(3.762)	(9.339)		(3.262)	(20.07)
Observations	9770	9770	3193	6859	6859	1100

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Family Structure includes a binary variable indicating if the parent is a lone parent, if there are multiple generations in the household and if the youngest child of the household is less than four years old and a continuous variable for number of children in the household.

Human Capital includes respondent's age, education in levels, years since migration, years since migration squared and a binary variable to indicate if the respondent does not state their years since migration.

Table A5: Determinants of Total School Minutes Per Day – Alternate methods (SE).

	Students						
	Tobit	**Reg.**	**Reg.>0**		**Tobit**	**Reg.**	**Reg.>0**
m_UKNA	-66.11 (36.92)	-35.60 (19.59)	-4.922 (22.95)	f_UKNA	-27.60 (32.07)	-21.13 (16.56)	-26.72* (13.03)
m_SCA	-104.3* (45.14)	-47.12* (19.20)	7.654 (14.51)	f_SCA	-19.69 (45.74)	-7.288 (24.98)	26.66 (25.93)
m_Europe	20.72 (21.39)	10.74 (11.89)	-4.070 (8.586)	f_Europe	6.766 (20.16)	2.393 (10.94)	-9.312 (8.034)
m_Africa	-86.13 (53.11)	-35.66 (24.82)	-6.397 (29.21)	f_Africa	-80.94 (54.82)	-34.49 (25.14)	-7.844 (24.92)
m_Asia	1.597 (20.82)	3.939 (11.61)	13.23 (10.21)	f_Asia	-11.15 (21.09)	-3.366 (11.47)	9.705 (10.28)
m_Other	-36.58 (43.19)	-21.62 (23.22)	-15.17 (22.15)	f_Other	-15.46 (36.74)	-14.94 (21.09)	-31.23 (20.75)
male	-12.49 (11.90)	-6.314 (6.515)	-0.390 (5.121)	male	-11.61 (11.97)	-5.924 (6.562)	-0.462 (5.163)
age	-12.88*** (2.623)	-7.681*** (1.367)	-5.457*** (1.404)	age	-12.96*** (2.628)	-7.711*** (1.368)	-5.595*** (1.402)
workhrs	-21.57*** (3.066)	-9.646*** (1.171)	-4.093* (1.666)	workhrs	-21.47*** (3.092)	-9.613*** (1.182)	-4.066* (1.668)
yr92	-28.27 (19.35)	-20.63 (10.82)	-18.03* (7.483)	yr92	-27.02 (19.45)	-19.81 (10.86)	-18.63* (7.470)
yr98	-46.00* (19.98)	-28.60* (11.12)	-13.58 (8.906)	yr98	-48.21* (20.06)	-29.32** (11.11)	-14.22 (8.827)
yr05	2.133 (17.24)	1.108 (9.985)	8.509 (7.298)	yr05	1.433 (17.42)	1.015 (10.07)	7.517 (7.358)
yr10	-18.47 (19.92)	-9.324 (11.34)	9.586 (8.475)	yr10	-19.01 (20.14)	-9.661 (11.43)	8.729 (8.516)
parentHH	-15.34 (18.07)	-7.747 (9.500)	-3.380 (9.902)	parentHH	-15.22 (18.22)	-7.676 (9.578)	-4.164 (9.968)
Constant	366.4*** (57.61)	334.3*** (30.17)	405.2*** (30.82)	Constant	366.0*** (57.88)	334.4*** (30.29)	411.0*** (30.96)
Sigma Constant	272.3*** (4.808)			Sigma Constant	273.1*** (4.796)		
Observations	3926	3926	2185	Observations	3926	3926	2185

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6: Determinants of Homework Minutes Per Day – Alternate methods (SE).

	Students						
	Tobit	**Reg.**	**Reg.>0**		**Tobit**	**Reg.**	**Reg.>0**
m_UKNA	2.476 (27.13)	1.167 (15.10)	22.56 (16.57)	f_UKNA	4.277 (26.90)	3.007 (15.03)	16.15 (18.53)
m_SCA	-15.67 (37.22)	-4.001 (21.38)	2.859 (33.29)	f_SCA	-27.42 (36.79)	-11.35 (22.09)	-8.509 (39.28)
m_Europe	50.45** (16.95)	23.83* (11.58)	3.754 (14.34)	f_Europe	37.23* (15.68)	15.62 (9.768)	0.181 (12.09)
m_Africa	20.21 (48.16)	20.46 (28.05)	75.25** (27.88)	f_Africa	61.18 (37.24)	41.43 (23.52)	50.30 (25.92)
m_Asia	91.15*** (16.17)	57.64*** (11.28)	51.16*** (13.29)	f_Asia	82.93*** (16.31)	51.06*** (11.32)	45.16*** (13.52)
m_Other	-6.776 (30.87)	-9.296 (16.14)	-18.11 (20.98)	f_Other	-5.705 (27.73)	-1.527 (14.42)	-6.276 (20.25)
male	-34.64*** (9.597)	-17.61** (5.807)	-15.44 (7.899)	male	-34.59*** (9.615)	-17.55** (5.817)	-15.98* (7.928)
age	18.30*** (2.208)	12.84*** (1.434)	18.57*** (1.797)	age	18.27*** (2.218)	12.85*** (1.442)	18.56*** (1.804)
workhrs	-18.61*** (2.439)	-8.744*** (0.925)	-8.220*** (1.503)	workhrs	-18.94*** (2.385)	-8.816*** (0.906)	-8.285*** (1.500)
yr92	-20.32 (16.85)	-12.91 (10.87)	-9.924 (14.88)	yr92	-19.15 (16.87)	-11.98 (10.87)	-10.73 (14.91)
yr98	-25.38 (16.79)	-17.18 (10.78)	-20.66 (14.19)	yr98	-25.32 (16.80)	-16.79 (10.79)	-20.01 (14.34)
yr05	-31.05* (15.09)	-22.12* (9.817)	-24.02 (12.98)	yr05	-30.65* (15.10)	-21.69* (9.846)	-22.83 (13.00)
yr10	-38.61* (16.62)	-27.00* (10.49)	-29.77* (13.81)	yr10	-38.72* (16.65)	-26.66* (10.51)	-28.34* (13.92)
parentHH	1.050 (15.99)	-2.087 (10.82)	-2.422 (14.06)	parentHH	0.963 (16.08)	-2.058 (10.87)	-2.644 (14.12)
Constant	-263.5*** (49.47)	-105.4** (32.10)	-135.1*** (40.06)	Constant	-262.6*** (49.77)	-105.5** (32.31)	-133.7*** (40.18)
Sigma Constant	212.2*** (5.462)			Sigma Constant	212.6*** (5.511)		
Observations	3926	3926	2163	Observations	3926	3926	2163

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A7: Craggit Marginal Effects

For the Cragg model, the probabilities regarding whether y is positive are,

$$P(y_i = 0|\boldsymbol{x_{1i}}) = 1 - \Phi(\boldsymbol{x_{1i}}\gamma)$$

and

$$P(y_i > 0|\boldsymbol{x_{1i}}) = \Phi(\boldsymbol{x_{1i}}\gamma)$$

where γ_j is an element in γ and γ_j is the coefficient representing the coefficient on x_j.

The partial effect on an independent variable, x_j, around the probability $y > 0$ is

$$\frac{\partial P(y > 0|\,\boldsymbol{x_1})}{\partial\, x_j} = \gamma_j \phi(\,\boldsymbol{x_1}\boldsymbol{\gamma})$$

and

$$\frac{\partial P(y = 0|\,\boldsymbol{x_1})}{\partial\, x_j} = -\gamma_j \phi(\,\boldsymbol{x_1}\boldsymbol{\gamma})$$

is the marginal effect around the probability $y = 0$. These probabilities and partial effects from are obtained from probit regression of w on $\boldsymbol{x_1}$.

The expected value of y is

$$E(y_i|\boldsymbol{x_{1i}}, \boldsymbol{x_{2i}}) = \Phi(\boldsymbol{x_{1i}}\boldsymbol{\gamma})\left\{\boldsymbol{x_{2i}}\boldsymbol{\beta} + \sigma \times \lambda\left(\boldsymbol{x_{2i}}\boldsymbol{\beta}/\sigma\right)\right\}.$$

where $\lambda(c)$ is the inverse Mills ratio

$$\lambda(c) = \phi(c)/\Phi(c).$$

The expected value of y conditional on $y > 0$ is

$$E(y_i|y_i > 0, \boldsymbol{x_{2i}}) = \boldsymbol{x_{2i}}\boldsymbol{\beta} + \sigma \times \lambda\left(\boldsymbol{x_{2i}}\boldsymbol{\beta}/\sigma\right).$$

The partial effect of an independent x_j on the expected value of y given $y > 0$ is

$$\frac{\partial E(y_i|y_i > 0, \boldsymbol{x_{2i}})}{\partial x_j} = \beta_j\left[1 - \lambda\left(\boldsymbol{x_2}\boldsymbol{\beta}/\sigma\right)\left\{\boldsymbol{x_2}\boldsymbol{\beta}/\sigma + \boldsymbol{\lambda}\left(\boldsymbol{x_2}\boldsymbol{\beta}/\sigma\right)\right\}\right]$$

and is the expected value and partial effect from a truncated regression of y on $\boldsymbol{x_2}$ Burke (2009).

Appendix B

Table B1: Human Capital Determinants of Poverty Regimes Multinomial Logit 2010 – 2015 (SE).

Estimated values of the covariates in model reported in row 2 Table 2-10

	R1	R2	R3	R4	R5
Immigrant	0.0368**	0.128***	-0.00114	0.0720***	-0.101*
	(0.0124)	(0.0187)	(0.00967)	(0.0174)	(0.0402)
Years since migration (ysm)	-0.000398	-0.00504**	0.000710	-0.00158	0.00775*
	(0.00103)	(0.00173)	(0.000887)	(0.00154)	(0.00328)
Not stated ysm	-0.0308***	0.0673	-0.0120***	-0.0625***	-0.139***
	(0.00315)	(0.110)	(0.00174)	(0.00420)	(0.00628)
Less than HS	0.0251**	0.0749***	0.0137*	0.0421**	-0.0537
	(0.00958)	(0.0144)	(0.00570)	(0.0145)	(0.0317)
High School	0.00645	0.0426***	-0.00209	0.0172	-0.0344
	(0.00812)	(0.0114)	(0.00545)	(0.0110)	(0.0198)
Bachelor	-0.0322**	-0.0112	0.00211	-0.0276	-0.000372
	(0.0113)	(0.0130)	(0.00545)	(0.0146)	(0.0178)
Grad	-0.0254*	-0.0454**	0.000481	-0.0137	-0.0150
	(0.0101)	(0.0151)	(0.00505)	(0.0124)	(0.0163)
Age	0.00119**	-0.00163*	0.000153	-0.00245***	0.00531***
	(0.000461)	(0.000684)	(0.000204)	(0.000672)	(0.000822)
Yr15	-0.0258***	-0.0124	-0.0127**	-0.000134	-0.0530***
	(0.00687)	(0.00869)	(0.00443)	(0.00845)	(0.0128)
Observations			5,031		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note (1) CES coefficients by Kmenta Approximation Method

(2) Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time

Table B2: Household Determinants of Poverty Regimes Multinomial Logit 2010 – 2015 (SE).

Estimated values of the covariates in model reported in row 3 Table 2-10

	R1	R2	R3	R4	R5
Immigrant	0.0258***	0.0651***	0.00499	0.0427***	-0.00769
	(0.00663)	(0.00926)	(0.00386)	(0.00911)	(0.0140)
Male	0.0213**	-0.0172	0.00806*	-0.0143	0.0582***
	(0.00692)	(0.00937)	(0.00401)	(0.00874)	(0.0120)
Work hours	0.00287***	-0.00660***	0.00149**	-0.00525***	0.0192***
	(0.000725)	(0.00109)	(0.000482)	(0.00112)	(0.00136)
Lone parent	0.0527***	0.131***	0.00955*	0.0330**	-0.0722*
	(0.00809)	(0.00951)	(0.00484)	(0.0109)	(0.0283)
Multiple generations	-0.00720	-0.120**	-0.00158	-0.0139	0.0592
	(0.0131)	(0.0423)	(0.0124)	(0.0277)	(0.0383)
Number of children	0.0103*	0.0207***	0.00391	0.00587	-0.0111
	(0.00421)	(0.00546)	(0.00219)	(0.00501)	(0.00727)
Age youngest child	0.00209*	-0.00260*	0.000155	-0.00357**	0.0104***
	(0.000875)	(0.00109)	(0.000358)	(0.00109)	(0.00144)
Yr15	-0.0250***	-0.0164*	-0.0112**	-0.00548	-0.0372**
	(0.00659)	(0.00827)	(0.00389)	(0.00827)	(0.0116)
Observations			5,031		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note (1) CES coefficients by Kmenta Approximation Method

(2) Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time

Table B3: Household and Human Capital Determinants of Poverty Regimes Multinomial Logit 2010 – 2015 (SE).

Estimated values of the covariates in model reported in row 4 Table 2-10.

	R1	R2	R3	R4	R5
Immigrant	0.0481***	0.123***	0.00178	0.0613***	-0.0519
	(0.0124)	(0.0181)	(0.00950)	(0.0174)	(0.0363)
Years since migration (ysm)	-0.000961	-0.00483**	0.000596	-0.000837	0.00376
	(0.00101)	(0.00169)	(0.000892)	(0.00157)	(0.00295)
Not stated ysm	-0.0308***	0.0838	-0.0120***	-0.0625***	-0.139***
	(0.00307)	(0.121)	(0.00173)	(0.00415)	(0.00594)
Less than HS	0.0206*	0.0612***	0.0117*	0.0410**	-0.0616*
	(0.00928)	(0.0152)	(0.00579)	(0.0146)	(0.0290)
High School	0.00355	0.0378***	-0.00326	0.0170	-0.0416*
	(0.00744)	(0.0109)	(0.00547)	(0.0110)	(0.0195)
Bachelor	-0.0291**	0.00639	0.00217	-0.0258	-0.00368
	(0.0110)	(0.0125)	(0.00571)	(0.0143)	(0.0163)
Grad	-0.0196*	-0.0316*	0.00101	-0.0152	-0.0160
	(0.00974)	(0.0147)	(0.00528)	(0.0125)	(0.0154)
Age	-0.00000936	-0.00100	-0.000221	-0.00118	-0.000195
	(0.000562)	(0.000938)	(0.000415)	(0.000837)	(0.00111)
Male	0.0203**	-0.0169	0.00808	-0.0129	0.0621***
	(0.00695)	(0.00931)	(0.00425)	(0.00878)	(0.0123)
Work hours	0.00300***	-0.00599***	0.00151**	-0.00481***	0.0191***
	(0.000687)	(0.00104)	(0.000481)	(0.00109)	(0.00136)
Lone parent	0.0473***	0.123***	0.00907	0.0241*	-0.0698*
	(0.00747)	(0.00942)	(0.00490)	(0.0109)	(0.0280)
Multiple generations	-0.00579	-0.110**	-0.00237	-0.0132	0.0528
	(0.0131)	(0.0412)	(0.0130)	(0.0278)	(0.0370)
Number of children	0.00962*	0.0198***	0.00389	0.00510	-0.0108
	(0.00417)	(0.00565)	(0.00240)	(0.00507)	(0.00732)
Age youngest child	0.00250*	-0.000801	0.000435	-0.00224	0.0102***
	(0.000994)	(0.00152)	(0.000618)	(0.00136)	(0.00177)
Yr15	-0.0230***	-0.0159	-0.0112**	-0.00201	-0.0430***
	(0.00657)	(0.00847)	(0.00429)	(0.00842)	(0.0122)
Observations			5,031		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note (1) CES coefficients by Kmenta Approximation Method

(2) Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time

Table B4: Determinants of Poverty Regimes Multinomial Logit 2010 – 2015 (SE).

Estimated values of the covariates in model reported in row 5 Table 2-10

	R1	R2	R3	R4	R5
Immigrant	0.0533***	0.133***	0.00135	0.0709***	-0.0534
	(0.0118)	(0.0180)	(0.00996)	(0.0177)	(0.0359)
Years since migration (ysm)	-0.000957	-0.00491**	0.000876	-0.000831	0.00334
	(0.000976)	(0.00168)	(0.000922)	(0.00155)	(0.00296)
Not stated ysm	-0.0308***	0.0818	-0.0120***	-0.0625***	-0.139***
	(0.00302)	(0.132)	(0.00173)	(0.00413)	(0.00592)
Less than HS	0.0185*	0.0619***	0.0106	0.0408**	-0.0596*
	(0.00894)	(0.0150)	(0.00579)	(0.0146)	(0.0290)
High School	0.00569	0.0395***	-0.00295	0.0177	-0.0407*
	(0.00731)	(0.0107)	(0.00548)	(0.0110)	(0.0196)
Bachelor	-0.0253*	0.00745	0.00355	-0.0239	-0.00659
	(0.0105)	(0.0125)	(0.00553)	(0.0145)	(0.0163)
Grad	-0.0180	-0.0270	0.00196	-0.0123	-0.0180
	(0.00957)	(0.0145)	(0.00520)	(0.0125)	(0.0156)
Age	0.0000398	-0.000905	-0.000128	-0.00104	-0.000426
	(0.000549)	(0.000915)	(0.000400)	(0.000819)	(0.00111)
Male	0.0191**	-0.0178	0.00745	-0.0137	0.0632***
	(0.00715)	(0.00921)	(0.00426)	(0.00870)	(0.0123)
Work hours	0.00300***	-0.00606***	0.00146**	-0.00490***	0.0191***
	(0.000666)	(0.00103)	(0.000473)	(0.00109)	(0.00134)
Lone parent	0.0452***	0.122***	0.00939*	0.0236*	-0.0705*
	(0.00761)	(0.00927)	(0.00477)	(0.0110)	(0.0281)
Multiple generations	-0.00290	-0.107**	-0.00137	-0.0109	0.0516
	(0.0132)	(0.0409)	(0.0124)	(0.0276)	(0.0365)
Number of children	0.00989*	0.0199***	0.00358	0.00463	-0.0108
	(0.00434)	(0.00573)	(0.00246)	(0.00513)	(0.00733)
Age youngest child	0.00264**	-0.000892	0.000375	-0.00235	0.0104***
	(0.000976)	(0.00148)	(0.000595)	(0.00135)	(0.00177)
CMA	-0.0128	-0.0262**	-0.00737	-0.0262*	0.0141
	(0.00661)	(0.00932)	(0.00443)	(0.0106)	(0.0131)
NF	0.0244	0.0125	-0.00173	0.0198	-0.0388
	(0.0132)	(0.0163)	(0.00835)	(0.0164)	(0.0246)
PE	0.0298*	-0.000481	-0.00635	0.000591	-0.0516
	(0.0136)	(0.0208)	(0.0128)	(0.0215)	(0.0341)
NS	-0.0142	0.0151	0.00419	-0.00469	-0.0222
	(0.0140)	(0.0185)	(0.00751)	(0.0180)	(0.0245)
NB	0.00598	0.0161	-0.00560	0.0120	-0.0205
	(0.0143)	(0.0174)	(0.0124)	(0.0160)	(0.0264)
QC	0.0221*	0.0120	0.00640	0.00711	-0.00890
	(0.00866)	(0.0110)	(0.00509)	(0.0117)	(0.0154)
MB	-0.0244	-0.0149	0.0154**	0.0218	-0.0536*
	(0.0149)	(0.0173)	(0.00593)	(0.0148)	(0.0256)
SK	0.00244	0.0123	0.00805	-0.00599	-0.0273
	(0.0114)	(0.0156)	(0.00612)	(0.0168)	(0.0237)
AB	-0.00878	-0.0549**	0.00935	-0.0414*	-0.00590
	(0.0117)	(0.0176)	(0.00574)	(0.0174)	(0.0233)
BC	-0.00277	0.0142	0.00959	0.00295	-0.0352
	(0.0104)	(0.0138)	(0.00595)	(0.0143)	(0.0202)
yr15	-0.0245***	-0.0138	-0.0114**	-0.000668	-0.0435***
	(0.00659)	(0.00847)	(0.00432)	(0.00864)	(0.0122)
Observations			5,031		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note (1) CES coefficients by Kmenta Approximation Method; (2) Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time

Table B5: Structural Form CES Coefficients NL 2010 – 2015 (SE). [+]

Constant	
$\hat{\gamma} = e^{\hat{\alpha}_0}$	1.262^{***} (0.11)
Returns to scale	
$\hat{v} = \hat{\alpha}_1 + \hat{\alpha}_2$	0.078^{***} (0.012)
Input coefficient	
$\hat{\delta} = \frac{\hat{\alpha}_1}{\hat{\alpha}_1 + \hat{\alpha}_2}$	0.689 (0.36)
Curvature parameter	
$\hat{\rho} = (-2)\frac{\hat{\alpha}_3}{\hat{\alpha}_1 - \frac{\hat{\alpha}_1^2}{\hat{\alpha}_1 + \hat{\alpha}_2}}$	-0.104 (0.33)
Substitution elasticity	
$\hat{\sigma} = \frac{1}{1 + \hat{\rho}}$	1.116 (0.42)

[*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$

[+]Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time.

Table B6: Determinants of Multidimensional Poverty Incidence Probit likelihood NL (SE). [+]

CES coefficients by Non-Linear (NL) Regression.

	Compensation_NL
Immigrant	0.198***
	(0.0228)
Years since migration (ysm)	-0.00613**
	(0.00209)
Not stated ysm	0.0634
	(0.139)
Less than HS	0.0910***
	(0.0182)
High School	0.0391**
	(0.0132)
Bachelor	-0.0166
	(0.0152)
Grad	-0.0380*
	(0.0158)
Age	-0.000726
	(0.00102)
Male	0.00622
	(0.0110)
Work hours	-0.000421
	(0.00120)
Lone parent	0.182***
	(0.0121)
Multiple generations	-0.0805*
	(0.0349)
Number of children	0.0311***
	(0.00672)
Age youngest child	0.00226
	(0.00171)
CMA	-0.0520***
	(0.0114)
yr15	-0.0500***
	(0.0103)
Province	Yes
Observations	5,031

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[+]Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time.

Table B7: Determinants of Poverty Regimes Multinomial Logit NL 2010 – 2015 (SE). +

CES coefficients by Non-Linear (NL) Regression.

	R1	R2	R3	R4	R5
Immigrant	0.0533***	0.132***	0.00285	0.0715***	-0.0539
	(0.0118)	(0.0175)	(0.00921)	(0.0185)	(0.0360)
Years since migration (ysm)	-0.000952	-0.00546***	0.000629	-0.000265	0.00349
	(0.000974)	(0.00163)	(0.000850)	(0.00165)	(0.00297)
Not stated ysm	-0.0308***	0.0746	-0.0109***	-0.0660***	-0.141***
	(0.00302)	(0.124)	(0.00167)	(0.00423)	(0.00592)
Less than HS	0.00300***	-0.00553***	0.00121**	-0.00543***	0.0194***
	(0.000666)	(0.000992)	(0.000449)	(0.00112)	(0.00134)
High School	0.0185*	0.0630***	0.00853	0.0393**	-0.0562
	(0.00893)	(0.0146)	(0.00556)	(0.0152)	(0.0287)
Bachelor	0.00570	0.0366***	-0.00308	0.0208	-0.0407*
	(0.00732)	(0.0104)	(0.00526)	(0.0112)	(0.0197)
Grad	-0.0253*	0.00699	0.00205	-0.0230	-0.00533
	(0.0105)	(0.0122)	(0.00546)	(0.0147)	(0.0163)
Age	-0.0180	-0.0218	-0.000142	-0.0167	-0.0161
	(0.00957)	(0.0141)	(0.00507)	(0.0130)	(0.0156)
Male	0.0000407	-0.000814	-0.0000743	-0.00114	-0.000473
	(0.000549)	(0.000897)	(0.000381)	(0.000837)	(0.00111)
Work hours	0.0191**	-0.0187*	0.00658	-0.0130	0.0641***
	(0.00716)	(0.00896)	(0.00413)	(0.00894)	(0.0123)
Lone parent	0.0453***	0.120***	0.00953*	0.0232*	-0.0709*
	(0.00759)	(0.00900)	(0.00442)	(0.0114)	(0.0282)
Multiple generations	-0.00304	-0.0996*	-0.0000620	-0.0156	0.0504
	(0.0132)	(0.0395)	(0.0112)	(0.0287)	(0.0367)
Number of children	0.00988*	0.0192***	0.00317	0.00539	-0.0104
	(0.00434)	(0.00566)	(0.00238)	(0.00517)	(0.00731)
Age youngest child	0.00264**	-0.000505	0.000158	-0.00274*	0.0106***
	(0.000975)	(0.00144)	(0.000562)	(0.00139)	(0.00177)
CMA	-0.0128	-0.0254**	-0.00763	-0.0269*	0.0142
	(0.00661)	(0.00912)	(0.00432)	(0.0108)	(0.0131)
NF	0.0244	0.0114	-0.00150	0.0212	-0.0391
	(0.0132)	(0.0161)	(0.00765)	(0.0167)	(0.0247)
PE	0.0298*	0.00164	-0.00572	-0.00184	-0.0522
	(0.0135)	(0.0201)	(0.0117)	(0.0224)	(0.0343)
NS	-0.0141	0.0148	0.00145	-0.00441	-0.0199
	(0.0140)	(0.0182)	(0.00775)	(0.0185)	(0.0243)
NB	0.00598	0.0180	-0.00508	0.0101	-0.0207
	(0.0143)	(0.0169)	(0.0113)	(0.0167)	(0.0265)
QC	0.0221*	0.0105	0.00624	0.00848	-0.00907
	(0.00866)	(0.0107)	(0.00472)	(0.0119)	(0.0154)
MB	-0.0243	-0.0146	0.0144**	0.0220	-0.0541*
	(0.0149)	(0.0170)	(0.00555)	(0.0152)	(0.0258)
SK	0.00241	0.00991	0.00148	-0.00324	-0.0206
	(0.0114)	(0.0153)	(0.00710)	(0.0169)	(0.0233)
AB	-0.00884	-0.0487**	0.00627	-0.0476**	-0.00258
	(0.0117)	(0.0169)	(0.00571)	(0.0181)	(0.0231)
BC	-0.00275	0.0138	0.00804	0.00338	-0.0337
	(0.0104)	(0.0133)	(0.00569)	(0.0148)	(0.0201)
yr15	-0.0245***	-0.0139	-0.0105*	-0.000588	-0.0444***
	(0.00659)	(0.00829)	(0.00424)	(0.00879)	(0.0122)
Observations			5,031		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

+Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time.

Table B8: OLS Regression and Probit Poverty Likelihoods Interact Multiple Generation (SE). [+]

CES coefficients by Kmenta Approximation Method

	OLS Regression		Poverty Incidence	
	Child-time	**Household Income**	**Child-time**	**Household Income**
immigrant	-52.51 (26.86)	-29,286.6*** (2657.6)	0.0350 (0.0366)	0.323*** (0.0356)
Multiple Generation	-85.01* (38.23)	7236.4 (3910.0)	0.0781 (0.0461)	-0.0772** (0.0259)
Immigrant*Multiple Generation	17.88 (64.04)	-5310.6 (5914.1)		
Observations	5,500	5,500	5,500	5,500

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[+]Sample: Parents with at least one child age<=14, valid Household Income, valid Life Satisfaction, outliers of Household Income removed, nonzero Household Income, nonzero Child Time.

Human Capital covariates: years since migration, years since migration squared, not stated years since migration, less than a high school diploma, high school diploma, bachelor's degree or higher than an bachelor degree and age of the respondent.

Household covariates: male, work hours of the respondent, lone parent status, multiple generations living in the household, the number of children in the household and age of the respondent's youngest child. Geography covariates include province and Census Metropolitan Area interactions. All models include a covariate for year.

Appendix C

Table C1a: Definition of paid work with GSS time-use activity codes 1986-2015.

Paid Work	Activity code
	1986-2010
Work for Pay	010
Work for pay at main job	011
Work for pay at other job(s)	012
Overtime work	020
Travel during work	030
Waiting/delays at work during work hours	040
Meals/snacks at work	050
Idle time before/after work	060
Coffee/other breaks at work	070
Other work activity	080
	2015
Paid work	08
Other income generating activities	10
Paid training	11
Break for lunch	12
Selling goods or services	40

Table C1b: Definition of HH Production with GSS time-use activity codes 1986-2015.

HH Production	Activity code
	1986-2010
Meal Preparation	100
Food (or meal) cleanup	110
Indoor cleaning	120
Outdoor cleaning (garbage, now removal, garage)	130
Laundry, ironing, folding	140
Mending	150
Home repairs, maintenance	160
Gardening, pet care	170
Other housework	180
Personal care of HH adults	271
Medical/emotional care of HH adults	272
Help and other care – household adults	282
Travel to/from personal care activities for HH adults	292

Everyday Shopping	300
Shopping for durable HH goods	310
Government and Financial services	330
Adult medical and dental	340
Other professional services (lawyer, veterinarian)	350
Repair Services (auto repair, dry cleaning etc.)	360
Waiting for purchases or services	370
Other shopping and services	380
Adult medical care	415
Help and Personal Care to Adults	420
	2015
Health professional visit, consultation	03
Self administered medical care	04
Meal, lunch or snack preparation	05
Preserving foods	17
Indoor house cleaning	18
Garbage, recycling, unpacking goods	19
Laundry, ironing, sewing, shoe care	20
Repair, painting, renovation	21
Organizing, planning, paying bills	22
Packing/unpacking groceries, luggage, boxes	23
Outdoor maintenance	24
Planting/maintaining garden or house plants	25
Pet care	26
Care of household child (15-17) personal care	29
Care of household child (15-17) accompanying	30
Care of household adult personal care	31
Care of household adult accompanying	32
Shopping or buying goods	37
Shopping for services	38
Researching for goods and services	39

Table C1c: Definition of Leisure with GSS time-use activity codes 1986-2015.

Leisure	Activity Code
	1986-2010
Unpaid babysitting	280
Meals at restaurant	440
Relaxing, thinking, resting, smoking	470
Leisure and special interest classes	560
Professional, union, general meetings	600

Political, civic activity, voting, jury duty, donating blood	610
Child, youth, family org., scout leader, school volunteer	620
Religious meetings, choir practice, church socials	630
Religious services/prayer/Bible readings	645
Meals/snacks/coffee at religious services	642
Fraternal organizations	650
Volunteer work, helping	665
Other organizational, voluntary and religious activity	680
Attend sports event	700
Pop music, fair, concerts,	710
Movies/film at a theatre/cinema	720
Classical music concerts, opera, ballet, theatre	730
Museums and art galleries	740
Visits, entertaining friends/relatives	750
Socializing at bars/clubs	765
Other social gatherings	780
Sports, physical exercise, coaching (golf, yoga, hockey)	80
Hunt, fish, camp	81
Walk, hike	82
Hobbies	83
Domestic home crafts	84
Music, theatre, dance	85
Games, cards, arcade	86
Pleasure drives, sightseeing	87
Other leisure activity	88
Listening to the radio	900
Television, rented movies	910
Listening to CD's, tapes, records	920
Reading books, magazines	930
Reading newspaper	940
Talking, conversation with HH member only (face-to-face)	950
Letters and mail	960
Other media communication	980
	2015
Self development or leisure courses	16
Helping relatives, friends, neighbours, acquaintances	36
Socializing or communicating in person	41
Socializing or communicating using technology	42
Organizational activities	43
Volunteer work	44
Religious activities	45
Civic participation	46
Exercising	47

Organized recreational sports	48
Competitive sports (indoor or outdoor)	49
Outdoor sports (non-competitive)	50
Outdoor activities	51
Coaching or administering sports	52
Attending cinema, exhibitions, library, concerts, theatre	53
Attending sporting events	54
Visiting museums, art galleries, heritage sites, zoos	55
Arts and hobbies	56
Leisure activities	57
Reading (Online or paper version)	58
Writing	59
Watching television or videos	60
Listening to music or radio	61
Use of technology	62

Table C1d: Definition of Child Service with GSS time-use activity codes 1986-2015.

Child Services	Activity Code
	1986-2015
Baby/child care (0 - 4 years old)	200
Child care	210
Helping/teaching/reprimanding	220
Reading/talking/conversation with child	230
Play with children	240
Medical/emotional of HH child	250
Unpaid babysitting of HH child	260
Other Childcare	280
Help and other care – household children	281
	2015
Care of household child <15 personal care	27
Care of household child <15 accompanying	28

Table C1e: Definition of Other with GSS time-use activity codes 1986-2015.

Other	Activity Code
	1986-2010
Residual Code	000
Looking for work	022
Unpaid work in a family business or farm	023

Travel to/from work	090
Travel to/from housework	190
Other Child Care (unpaid babysitting)	280
Travel to/from care activities for HH children	291
Personal Care Services (barbers, beauticians)	320
Travel to/from shopping	390
Washing, dressing	400
Meal at home/snacks/coffee	435
Nights Sleep	450
Naps	460
Other personal care (washroom)	480
Travel to/from personal activities/restaurant meals	490
Full-time classes	500
Other Classes – part-time	510
Special Lectures	520
Homework	530
Meals/snacks/coffee at school	540
Breaks/waiting for class	550
Unpaid Babysitting	673
Travel to/from school education activities	590
Travel to/from organizational/voluntary/religious activities	690
Travel to/from attending entertainment	790
Travel to/from participating in hobbies	890
Travel to/from media and communication activities	990
	2015
Sleeping, resting, relaxing, sick in bed	01
Personal care	02
Eating or drinking	06
Transport to and from activity	07
Looking for paid work	09
Schooling on site	13
Schooling online	14
Homework or studying	15
Care of child (other household) personal or accompanying	33
Care of adult (other household) personal care	34
Care of adult (other household) accompanying	35
Other activity	63
Uncodable/unknown activity	95

Table C1f: Definition of School with GSS time-use activity codes 1986-2015.

Education	Activity Code
	1986-2010
Full-time classes	500
Other Classes – part-time	510
Homework	530
	2015
Schooling on site	13
Schooling online	14
Homework or studying	15

Table C2: Mothers Average Time-use minutes per day by year and Place of Birth (SE).

Paid Work	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0	**Leisure**	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0
1986	158.59 (5.97)	193.33 (12.60)	Z=-2.513 P<z=0.006 P>|z|=0.012 P>z=0.9940	1986	270.09 (4.40)	225.13 (8.02)	Z=4.92 P<z=1.000 P>|z|=0.000 P>z=0.000
1992	147.42 (6.05)	192.32 (14.20)	Z=-2.909 P<z=0.002 P>|z|=0.004 P>z=0.998	1992	266.97 (5.07)	187.31 (9.98)	Z=7.115 P<z=1.000 P>|z|=0.000 P>z=0.000
1998	191.93 (6.73)	196.93 (14.48)	Z=-0.263 P<z=0.396 P>|z|=0.793 P>z=0.604	1998	265.51 (4.84)	228.92 (9.28)	Z=3.50 P<z=0.999 P>|z|=0.0005 P>z=0.0002
2005	201.91 (5.61)	202.53 (10.73)	Z=-0.051 P<z=0.480 P>|z|=0.960 P>z=0.520	2005	247.07 (4.02)	222.30 (7.50)	Z=2.91 P<z=0.998 P>|z|=0.004 P>z=0.002
2010	191.79 (6.60)	181.23 (11.51)	Z=0.796 P<z=0.787 P>|z|=0.426 P>z=0.213	2010	243.27 (4.67)	220.80 (7.81)	Z=2.470 P<z=0.993 P>|z|=0.014 P>z=0.007
2015	214.35 (7.44)	205.14 (10.24)	Z=0.728 P<z=0.767 P>|z|=0.467 P>z=0.233	2015	210.35 (4.97)	180.46 (6.75)	Z=0.728 P<z=1.000 P>|z|=0.0004 P>z=0.0002
HH Prod.	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0	**Child Service**	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0
1986	233.02 (4.27)	234.66 (7.50)	Z=0.-0.190 P<z=0.425 P>|z|=0.850 P>z=0.575	1986	94.71 (2.99)	92.98 (5.03)	Z=0.296 P<z=0.616 P>|z|=0.768 P>z=0.384
1992	219.67 (4.35)	205.39 (10.05)	Z=1.304 P<z=0.904 P>|z|=0.192 P>z=0.096	1992	113.88 (3.33)	94.90 (6.87)	Z=2.49 P<z=0.994 P>|z|=0.013 P>z=0.006
1998	217.26 (4.06)	231.06 (9.44)	Z=-1.342 P<z=0.089 P>|z|=0.179 P>z=0.910	1998	117.69 (3.39)	114.30 (7.10)	Z=0.431 P<z=0.667 P>|z|=0.666 P>z=0.333
2005	204.54 (3.50)	210.16 (6.67)	Z=-0.746 P<z=0.228 P>|z|=0.456 P>z=0.772	2005	129.12 (3.17)	128.50 (6.03)	Z=0.091 P<z=0.536 P>|z|=0.928 P>z=0.464
2010	204.13 (4.17)	213.36 (7.43)	Z=-1.083 P<z=0.139 P>|z|=0.279 P>z=0.861	2010	145.93 (3.89)	170.25 (8.01)	Z=-2.73 P<z=0.003 P>|z|=0.006 P>z=0.997
2015	190.24 (4.55)	212.48 (6.95)	Z=-2.677 P<z=0.004 P>|z|=0.007 P>z=0.996	2015	114.68 (4.30)	103.79 (6.26)	Z=1.434 P<z=0.924 P>|z|=0.152 P>z=0.076
Observations	9,149	1,919		Observations	9,149	1,919	
	11,068				11,068		

Table C3: Fathers average time-use minutes per day by year and Place of Birth (SE).

Paid Work	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0	**Leisure**	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0
1986	398.18 (8.77)	416.35 (16.12)	Z=-0.99 P<z=0.1611 P>|z|=0.322 P>z=0.839	1986	257.98 (5.85)	239.58 (10.51)	Z=1.529 P<z=0.937 P>|z|=0.126 P>z=0.063
1992	356.37 (9.82)	336.93 (19.13)	Z=0.904 P<z=0.817 P>|z|=0.366 P>z=0.183	1992	261.82 (6.55)	220.38 (12.56)	Z=2.93 P<z=0.998 P>|z|=0.003 P>z=0.002
1998	359.32 (10.06)	396.48 (20.21)	Z=-1.646 P<z=0.050 P>|z|=0.100 P>z=0.950	1998	266.94 (6.77)	247.20 (12.00)	Z=-1.432 P<z=0.924 P>|z|=0.152 P>z=0.076
2005	391.81 (7.81)	397.90 (14.97)	Z=-0.361 P<z=0.360 P>|z|=0.718 P>z=0.641	2005	240.94 (5.22)	242.28 (8.28)	Z=-0.137 P<z=0.446 P>|z|=0.891 P>z=0.554
2010	348.88 (9.13)	353.08 (16.69)	Z=-0.221 P<z=0.413 P>|z|=0.826 P>z=0.587	2010	259.01 (6.46)	237.73 (10.82)	Z=1.689 P<z=0.954 P>|z|=0.091 P>z=0.046
2015	343.24 (9.94)	365.44 (12.91)	Z=-1.362 P<z=0.173 P>|z|=0.155 P>z=0.913	2015	207.80 (5.92)	181.30 (7.64)	Z=2.741 P<z=0.997 P>|z|=0.006 P>z=0.003
HH Prod.	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0	**Child Service**	Canada	Abroad	Ho: mean(Canada) - mean(Abroad) = 0
1986	97.29 (4.61)	77.04 (7.55)	Z=2.29 P<z=1.000 P>|z|=0.022 P>z=0.011	1986	40.16 (2.41)	34.08 (4.79)	Z=1.134 P<z=0.872 P>|z|=0.257 P>z=0.128
1992	103.62 (4.47)	78.94 (7.32)	Z=2.878 P<z=0.998 P>|z|=0.004 P>z=0.002	1992	46.32 (2.44)	49.28 (5.01)	Z=-0.531 P<z=0.298 P>|z|=0.595 P>z=0.702
1998	120.84 (5.03)	107.74 (9.40)	Z=1.229 P<z=0.890 P>|z|=0.219 P>z=0.110	1998	60.65 (3.09)	69.53 (7.17)	Z=-1.137 P<z=0.128 P>|z|=0.256 P>z=0.872
2005	111.12 (3.92)	90.23 (6.36)	Z=2.800 P<z=0.997 P>|z|=0.005 P>z=0.003	2005	61.80 (2.46)	63.86 (5.33)	Z=-0.351 P<z=0.363 P>|z|=0.726 P>z=0.637
2010	120.68 (4.65)	133.13 (9.21)	Z=-1.21 P<z=0.112 P>|z|=0.228 P>z=0.886	2010	78.66 (3.67)	59.87 (3.66)	Z=3.63 P<z=1.000 P>|z|=0.0003 P>z=0.0001
2015	135.07 (5.60)	118.38 (6.61)	Z=1.92 P<z=0.973 P>|z|=0.054 P>z=0.027	2015	64.63 (3.49)	53.64 (4.61)	Z=1.90 P<z=0.971 P>|z|=0.057 P>z=0.029
Observations	6,406	1,414		Observations	6,406	1,414	
	7,820				7,820		

Table C4: Young Adults average time-use by year and generation status (SE).*

Paid work	Third+	Second	Ho: mean(Third+) - mean(Second) = 0	**Leisure**	Third+	Second	Ho: mean(Third+) - mean(Second) = 0
1986	181.55 (8.75)	154.50 (14.98)	Z=1.91 P<z=0.972 P>|z|=0.056 P>z=0.028	1986	314.17 (6.87)	329.14 (14.69)	Z=-1.17 P<z=0.120 P>|z|=0.241 P>z=0.880
1992	169.46 (8.65)	138.26 (14.87)	Z=2.16 P<z=0.985 P>|z|=0.031 P>z=0.015	1992	345.38 (7.52)	319.22 (13.79)	Z=1.96 P<z=0.975 P>|z|=0.050 P>z=0.025
1998	168.48 (9.32)	169.89 (17.33)	Z=-0.090 P<z=0.464 P>|z|=0.928 P>z=0.536	1998	371.25 (8.34)	374.19 (15.96)	Z=-0.216 P<z=0.414 P>|z|=0.829 P>z=0.586
2005	192.83 (7.00)	168.99 (14.29)	Z=1.78 P<z=0.962 P>|z|=0.075 P>z=0.038	2005	354.35 (5.86)	363.61 (12.97)	Z=-0.742 P<z=0.229 P>|z|=0.458 P>z=0.771
2010	152.92 (8.85)	164.01 (17.14)	Z=-0.702 P<z=0.241 P>|z|=0.483 P>z=0.759	2010	367.40 (8.74)	364.94 (15.02)	Z=-0.164 P<z=0.565 P>|z|=0.870 P>z=0.435
2015	185.21 (10.35)	113.50 (14.39)	Z=4.87 P<z=1.000 P>|z|=0.000 P>z=0.000	2015	311.73 (9.54)	314.73 (16.36)	Z=-0.192 P<z=0.424 P>|z|=0.848 P>z=0.576
HH Prod.	Third+	Second	Ho: mean(Third+) - mean(Second) = 0	**Education**	Third+	Second	Ho: mean(Third+) - mean(Second) = 0
1986	84.19 (3.62)	64.05 (6.07)	Z=3.29 P<z=0.999 P>|z|=0.001 P>z=0.0005	1986	129.62 (7.86)	164.77 (15.48)	Z=-2.63 P<z=0.004 P>|z|=0.009 P>z=0.996
1992	77.14 (3.42)	70.04 (7.25)	Z=0.999 P<z=0.841 P>|z|=0.318 P>z=0.159	1992	97.94 (5.98)	130.13 (13.43)	Z=-2.64 P<z=0.004 P>|z|=0.008 P>z=0.996
1998	80.07 (3.95)	74.99 (6.15)	Z=0.863 P<z=0.806 P>|z|=0.388 P>z=0.194	1998	112.38 (7.25)	121.55 (13.34)	Z=-0.781 P<z=0.217 P>|z|=0.435 P>z=0.783
2005	68.18 (2.75)	64.09 (5.53)	Z=0.756 P<z=0.775 P>|z|=0.450 P>z=0.225	2005	116.38 (5.10)	138.01 (11.44)	Z=-1.97 P<z=0.025 P>|z|=0.049 P>z=0.975
2010	70.16 (3.76)	70.12 (7.91)	Z=0.006 P<z=0.502 P>|z|=0.996 P>z=0.498	2010	123.42 (6.99)	131.87 (13.88)	Z=-0.646 P<z=0.259 P>|z|=0.518 P>z=0.741
2015	80.35 (5.03)	70.49 (7.02)	Z=1.409 P<z=0.921 P>|z|=0.159 P>z=0.080	2015	111.50 (8.04)	167.05 (16.76)	Z=-3.680 P<z=0.0001 P>|z|=0.0002 P>z=0.999
Observations	7,998	1,959		Observations	7,998	1,959	
	9,957				9,957		

Table C5: Estimation of OLS Regression and Tobit Model (SE).*

Mothers

	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
Africa	-16.70	1.86	-28.80*	5.88
	(19.43)	(11.95)	(12.86)	(12.44)
Asia	-52.15**	19.43	-20.62	7.71
	(17.49)	(14.03)	(12.58)	(15.77)
Europe	-30.85	23.16	-30.53*	5.41
	(20.90)	(15.51)	(13.64)	(12.96)
SCA	-31.69	6.45	-26.25	10.67
	(22.66)	(16.61)	(16.19)	(15.41)
UKNA	-76.09***	29.58*	6.50	18.81
	(17.62)	(15.07)	(14.95)	(14.90)
Other	-61.02	-16.02	-94.24**	27.86
	(39.01)	(33.42)	(35.33)	(19.50)
YSM	yes	yes	yes	yes
Observations		10,732		

Fathers

	Paid Work Reg	HH Prod Tobit	Leisure Reg	Child Service Tobit
Africa	-8.30	-21.29*	-17.59	4.04
	(25.34)	(9.89)	(16.23)	(7.51)
Asia	0.51	-14.05	-34.73*	-7.95
	(24.14)	(9.83)	(15.66)	(7.22)
Europe	-13.52	0.86	-7.21	-6.39
	(27.15)	(13.04)	(18.28)	(7.36)
SCA	11.75	8.11	-23.65	-29.81***
	(29.50)	(15.98)	(21.26)	(5.74)
UKNA	-67.91**	11.88	12.23	11.49
	(26.11)	(13.58)	(18.97)	(8.60)
Other	20.37	-24.45	-34.29	-4.75
	(50.97)	(26.67)	(24.95)	(11.35)
YSM	yes	yes	yes	yes
Observations		7,831		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm, ysm^2, nsysm, sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, age_ch 5-9, weekend, CMA, province, and year. Results available upon request.

Table C6: Estimation of OLS Regression Young Adults (SE).*

Young Adults

	Paid Work Reg	HH Prod Reg	Leisure Reg	Education Reg		Paid Work Reg	HH Prod Reg	Leisure Reg	Education Reg
m_Africa	-13.78	0.277	-66.56***	31.05	f_Africa	-10.92	2.091	-65.59***	41.65*
	(20.69)	(9.533)	(18.34)	(20.88)		(19.53)	(9.898)	(18.45)	(20.68)
m_Asia	-41.00***	-3.943	-15.34	54.22***	f_Asia	-30.87**	-7.403	-21.11*	48.26***
	(11.21)	(4.914)	(10.95)	(11.09)		(11.01)	(4.511)	(10.58)	(10.51)
m_Europe	-26.42*	0.243	-24.82*	27.60*	f_Europe	-16.69	-1.068	-15.64	23.66*
	(12.65)	(6.099)	(11.43)	(11.48)		(12.06)	(5.451)	(11.31)	(10.65)
m_SCA	-23.43	-0.700	4.116	14.37	f_SCA	-34.38	-1.217	-0.434	16.82
	(19.55)	(8.579)	(17.98)	(17.52)		(17.86)	(7.974)	(16.77)	(17.87)
m_UKNA	-20.14	2.355	39.34*	-14.61	f_UKNA	-14.62	-0.0248	9.440	0.765
	(16.35)	(6.069)	(15.50)	(12.39)		(15.18)	(5.869)	(14.67)	(12.21)
m_Other	17.24	15.67	-31.38	-20.38	f_Other	25.54	9.100	-13.17	-22.73
	(21.13)	(9.692)	(17.19)	(13.17)		(19.10)	(8.468)	(15.72)	(12.00)
Observations	11,158	11,158	11,158	11,158	Observations	11,158	11,158	11,158	11,158

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates born abroad, male, age, parentHH, weekend, CMA, prov., and year. Results available upon request.

Table C7: Fathers SUR model Child Service Regression (SE).*

	Paid work Reg	HH Prod Tobit	Leisure Reg	Child Service Reg
Africa	-8.30	-21.44*	-17.59	1.58
	(25.34)	(9.90)	(16.23)	(8.11)
Asia	0.51	-14.34	-34.73*	-9.29
	(24.14)	(9.84)	(15.66)	(9.05)
Europe	-13.52	0.73	-7.21	-10.95
	(27.15)	(13.03)	(18.28)	(8.34)
SCA	11.75	7.76	-23.65	-39.53***
	(29.50)	(16.00)	(21.26)	(7.82)
UKNA	-67.91**	11.68	12.23	3.97
	(26.11)	(13.58)	(18.97)	(8.40)
Other	20.37	-24.96	-34.29	-5.20
	(50.97)	(26.69)	(24.95)	(11.70)
Observations		7,381		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

*Covariates ysm, ysm^2, nsysm, sec_gen, age, education, multi_gen, lone-parent, num_child, age_ch 0-4, age_ch 5-9, weekend, CMA, province, and year. Results available upon request.

B8: Computing Marginal Effects

To estimate the change in time-use categories and parental and household characteristics, which depend on the level of another x-covariate in the system, I re-specify equation (1) for an interaction term. For instance, if x_1 and x_2 share an interdependent relationship, the demand functions in equation (1) will look like:

$$t_j = \beta_{oj} + \beta_{1j}\boldsymbol{x_1} + \beta_{2j}\boldsymbol{x_2} + \beta_{3j}\boldsymbol{x_1}\boldsymbol{x_2} + \boldsymbol{\beta}'_j\boldsymbol{X} + \varepsilon_j \qquad \text{for } j = pw, hh, l, cs \qquad (a)$$

The total partial effect in equation (a) for a change in covariate x_1 in time-use category *j* is:

$$\frac{\partial t}{\partial x_1} = \beta_1 + \beta_3 x_2$$

The partial effect of x_1 is evaluated with the change in all other variables equal to zero,

$$\left.\frac{\partial t}{\partial x_1}\right|_{\mathrm{x}_2=0} = \beta_1$$

Likewise, the estimate for x_2 is:

$$\left.\frac{\partial t}{\partial x_2}\right|_{\mathrm{x}_1=0} = \beta_2$$

and the beta coefficient on the interaction term is the cross-derivative:

$$\frac{\partial t}{\partial x_1 \partial x_2} = \beta_3$$

Since Tobit models are non-linear, the total partial effect of x_1 is the derivate of equation (4) with respect to x_1:

$$\tfrac{\partial t}{\partial x_1} = (\beta_1 + \beta_3 \boldsymbol{x}_2)\left(\Phi\left(\tfrac{0-\boldsymbol{\beta}'\boldsymbol{x}}{\sigma}\right) - \Phi\left(\tfrac{+\infty-\beta'\boldsymbol{x}}{\sigma}\right)\right)$$

The partial effect captures both the impact of x_1, β_1, and the extent to which x_1 is correlated with x_2, β_3, and a standard error of this estimate (Drichoutis 2011).