Do Borrowing Constraints Matter for Intergenerational Educational Mobility? Evidence from Japan

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Abstract

This paper examines the intergenerational transmission of educational attainment using micro data from a Japanese survey. By exploiting unique information on whether children have ever given up schooling for financial reasons and, if they have, which level of schooling they have forgone, it attempts to assess the role of borrowing constraints in determining intergenerational educational mobility in a more direct manner than previous attempts made in the literature. Despite a steady increase in the level of educational attainment, the regression results indicate the absence of an increase in intergenerational educational mobility during the postwar period in Japan. We also find that while borrowing constraints used to play a significant role in lowering intergenerational educational mobility, they no longer seem to matter for the youngest cohort we examined in this paper. Instead, our analysis shows that the relative importance of adolescent academic ability for children's educational attainment has increased in recent years, thereby underlining the increasing importance of earlier investments in children's human capital for their subsequent academic advancement.

Keywords: borrowing constraints, education, intergenerational mobility, Japan
JEL classification codes: I24, J62

1. Introduction

Intergenerational mobility measures the degree to which socioeconomic status is transmitted from one generation to the next, and as such, it can be considered a fundamental indicator of the equality of economic opportunities in a society. A strong association between the socioeconomic status of parents and that of children indicates low intergenerational mobility whereby children from a disadvantaged family are likely to remain disadvantaged throughout their lives and may not be able to achieve their economic potential regardless of their abilities or efforts (Blanden, Gregg, and Macmillan 2007).

While various aspects of intergenerational mobility have been measured in the past, including earnings, occupation, and education, this paper pays particular attention to the intergenerational transmission of educational attainment. According to the intergenerational human capital investment model proposed by Becker and Tomes (1986), education, or human capital, is an important channel through which earnings ability is transmitted from parents to children. High-earning parents have a greater financial capacity to invest in their children's education. Such parents may also pass on certain attributes (genetic and cultural endowments) to their children, which make it easier for children to acquire education. More education then enables children to obtain higher earnings in adulthood. Education therefore plays a central role in passing on socioeconomic advantage (or disadvantage) from generation to generation.

Besides the importance of examining the intergenerational transmission of educational attainment per se, there are a number of advantages to using education, rather than earnings, to measure intergenerational mobility. Education is less sensitive to well-known problems with measurement error and life cycle bias than earnings (Solon 1992; Mazumder 2005; Zimmerman 1992). Information on the educational attainment of both parents and children is more readily available in household surveys and recall-based information on the educational attainment of parents is likely to be of better quality than that on their earnings. Since education is a more or less permanent characteristic and most individuals complete their education by their mid-20s, education is also less prone to life cycle bias than earnings. As a result, in the absence of accurate information on permanent income, the use of education is arguably the best way to measure the intergenerational transmission of socioeconomic status. Moreover, Blanden (2013) shows that intergenerational mobility in earnings and education tend to be highly correlated and

suggests that educational mobility could be considered a good proxy for earnings mobility.

There is a growing literature that examines the intergenerational transmission of educational attainment, and the empirical evidence consistently shows a strong association between parents' and children's educational attainment.[3] On the other hand, the evidence on the importance of borrowing constraints for children's educational attainment as well as for intergenerational earnings/educational mobility remains inconclusive. For instance, several studies find that parents' financial resources play only a limited role in children's educational attainment, suggesting that borrowing constraints are relatively unimportant (e.g., Cameron and Heckman 1998, 2001; Carneiro and Heckman 2002) while other studies find stronger evidence of borrowing constraints, particularly in more recent years (e.g., Belley and Lochner 2007; Lochner and Monge-Naranjo 2012).

Note that when discussing the equality of opportunity, the determinants of any outcome can be separated into two components: "circumstances," such as family background, and "efforts" (e.g., Roemer 1998). Inequality arising from circumstances that are beyond one's control certainly calls for policy interventions. Given that borrowing constraints for children's education largely stem from circumstances, analyzing the relative importance of borrowing constraints for intergenerational mobility has important policy implications. If borrowing constraints are responsible for the intergenerational persistence of educational attainment, measures for relaxing such constraints should be adopted. However, if the formation of children's human capital is determined mainly by families' underlying characteristics (e.g., genetic and cultural environments including aspiration for education) that are passed on from generation to generation, policies that merely address financial constraints would not be effective in addressing the intergenerational persistence of educational attainment and there is room for discussion about whether policy interventions are needed (and if so, what interventions are needed) to address the lack of intergenerational mobility.

Nevertheless, examining empirically the importance of borrowing constraints for children's educational attainment and intergenerational mobility is not a straightforward exercise given the difficulty of identifying which families are credit constrained. Whether or not borrowing constraints bind is determined not only by parents' financial resources

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[3] See Black and Devereux (2011) for a comprehensive survey of the literature on intergenerational mobility.

but also by the endowed ability of children and whether well-functioning credit markets (or alternatives to credit market financing of human capital investment) exist in a society (Grawe and Mulligan 2002). Fortunately, the Preference Parameters Study of Osaka University, which we use for our analysis, contains unique information on whether children have ever given up schooling for financial reasons, and if they have, which level of schooling they have forgone. By exploiting such information, this paper aims to contribute to the existing literature on the implications of borrowing constraints for the intergenerational transmission of educational attainment in two ways.

First, we assess the importance of borrowing constraints for intergenerational educational mobility by comparing the extent of the intergenerational transmission of educational attainment estimated using the number of years of schooling that children actually completed with that estimated using the hypothetical number of years of schooling for children who had to give up schooling for financial reasons assuming that they had not faced borrowing constraints. We believe that this is a more direct way of assessing the importance of borrowing constraints for intergenerational educational mobility than previous attempts made in the literature.

Second, by analyzing the case of Japan, we try to broaden our understanding of the intergenerational transmission of educational attainment and the role of borrowing constraints in determining it in Japan, for which empirical evidence hardly exists. Japan is an interesting case to study given that Japanese parents tend to bear the relatively heavy financial burden of tuition fees for tertiary education and that they also tend to bear the high cost of sending their children to cram schools to make sure that their children are well prepared to succeed in the fierce competition for entrance to upper secondary schools and universities (or even to lower levels of schooling).[4]

The rest of the paper is structured as follows. The next section describes the conceptual framework. Section 3 reviews the related literature with a particular focus on the empirical evidence on the role of borrowing constraints in intergenerational mobility. Section 4 describes the education system in Japan. Section 5 describes the data and estimation methods. Section 6 presents the estimation results. Section 7 ends with some

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[4] For instance, according to the National Transfer Accounts data collected by the Center for the Economics and Demography of Aging, University of California at Berkeley (available at http://www.ntaccounts.org/web/nta/show/Country%20Summaries), about 94% of the private consumption of those aged 18–21 is financed by private transfers (predominantly from parents) in the case of Japan, whereas the corresponding figure for the United States is about 58% (Niimi and Horioka 2017).

concluding remarks.

2. Conceptual Framework

The empirical analysis of the intergenerational transmission of educational attainment in this paper is based on the intergenerational human capital investment model developed by Becker and Tomes (1986) for analyzing the intergenerational transmission of earnings, assets, and consumption across generations. The model posits education, or human capital, as the central mechanism through which socioeconomic advantage (or disadvantage) is passed on across generations. In the model, a child's earnings or economic status in adulthood depend on his/her endowments as well as on his/her parents' investments in the child's human capital. Children are assumed to inherit genetic and cultural endowments (e.g., genetic traits, cognitive and noncognitive abilities, and family environment) from parents while utility-maximizing parents are assumed to be altruistic and make optimal investments in their children's human capital.

If parents can readily borrow to finance optimal investments in their children, the degree of intergenerational earnings mobility will simply be equal to the inheritability of endowments given that there will be no direct relationship between parents' financial resources and investments in their children's human capital. In this case, an autoregressive process in earnings across generations is expected.

By contrast, if access to capital markets is limited and parents cannot borrow against their children's future earnings to finance investments in children's human capital, this is likely to result in the intergenerational persistence of human capital and earnings. Financial market imperfections are likely to occur because children cannot credibly commit to paying back the loans parents take out on their behalf. In such a case, given that high-income families can more readily self-finance a given amount of investment in their children than low- and middle-income families, the inability of parents to borrow depresses the earnings of poor children vis-à-vis rich children with the same ability. This, in turn, strengthens the correlation between the earnings of parents and children in families that do not have enough funds to invest optimally in their children's human capital. In other words, in the presence of imperfect credit markets, the degree of intergenerational earnings mobility will also depend on the earnings of parents and their willingness to self-finance investments in their children.

In sum, the intergenerational transmission of human capital and earnings rests upon the intergenerational transmission of endowments, either genetically or through the environment, and the presence of borrowing constraints. In the presence of borrowing constraints, the model predicts that intergenerational earnings/educational mobility would be lower among constrained groups than among unconstrained groups given that the former would make a suboptimal investment in their children's human capital.

Note, however, that the model proposed by Becker and Tomes (1986) predicts that the presence of borrowing constraints merely slows down the process of convergence of successive generations toward the mean and does not prevent it in the long term. Nevertheless, given that this seems at odds with the observed intergenerational persistence of educational attainment, a number of alternative models have subsequently been developed to explain this phenomenon.[5]

Becker *et al*. (2015), for example, consider how the persistence of economic status depends on the distribution of income, and in doing so, they emphasize the importance of complementarities between parents' human capital and investments in children in the production of children's human capital (i.e., highly educated parents are more productive at teaching their children). They show that when returns to investments in children increase in parents' human capital, the equilibrium relationship between parents' and children's human capital tends to be convex, resulting in greater intergenerational persistence among high-income families even in a world with perfect capital markets and without differences in children's innate ability. On the other hand, borrowing constraints may produce high persistence among low-income families. As a consequence, their theory predicts that intergenerational mobility will be low at both ends of the income distribution and that successive generations of the same family may cease to regress toward the mean if complementarities in the production of children's human capital are strong enough (Becker *et al*. 2015).[6]

Moreover, Hellier (2017) provides a useful synthetic and encompassing framework for modeling several factors that have been considered in the literature as determinants of the

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[5] See Chusseau, Hellier, and Ben-Halima (2013) and Hellier (2017) for a comprehensive review of the theoretical literature.
[6] Heckman and Mosso (2014) similarly note that even in the absence of imperfect credit markets, the intergenerational correlation between human capital and earnings may be observed due, for example, to the *accident of birth* because returns to parental investments depend on parents' own human capital by affecting the productivity of investments.

slowdown in the pace of human capital convergence or of the emergence of human capital stratification/low-education traps. These include credit market imperfections, fixed costs of education, "S-shaped" production of children's human capital, local externalities and neighborhood effects, and the structure of education systems. As shown in Hellier (2017), many of these factors, as well as various combinations thereof, can divide the population between several education groups, causing education-based social stratification and low-education traps.

While all of these factors are equally important, we focus our analysis on the role of borrowing constraints in determining intergenerational educational mobility.

3. Related Literature on Borrowing Constraints

According to the conceptual framework discussed above, the intergenerational transmission of socioeconomic status would be greater in a world with borrowing constraints. However, the evidence on the role of borrowing constraints in determining intergenerational earnings mobility has so far been mixed.[7] Moreover, it is not a straightforward exercise to test this hypothesis empirically given the difficulty of identifying which families are credit constrained.

Whether or not borrowing constraints bind is determined not only by family income but also by the endowed ability of children and whether well-functioning credit markets (or alternatives to credit market financing of human capital investment) exist in a society (Grawe and Mulligan 2002). Han and Mulligan (2001) indeed suggest that heterogeneity in "innate" earnings ability makes it difficult to detect the existence and importance of borrowing constraints given that high-earning parents tend to have high-ability children. Corak and Heisz (1999), for instance, find relatively low intergenerational earnings mobility among middle-income families using data on Canada. They suggest that middle-income parents may be most susceptible to borrowing constraints given that low-income parents are more likely to have low-ability children requiring less investment in human capital while high-income parents are more capable of financing the optimal level of investment in their children's human capital even if their children's ability is relatively high. On the other hand, Grawe (2004) argues that unless the relationship between parents' and children's earnings is linear in the absence of borrowing constraints, nonlinear

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[7] See Black and Devereux (2011) for a comprehensive survey of the literature on intergenerational mobility.

earnings regressions do not constitute proof of the existence of borrowing constraints.

Another approach used to test for the presence of borrowing constraints is to identify groups that are more likely to be credit constrained. Given that theory predicts that high-ability children are more likely to be credit constrained for any given level of parental earnings, Grawe (2004) uses children's earnings as a proxy for their ability and applies a quantile regression approach to Canadian data. Contrary to expectation, no persistence in earnings is detected among high-ability children born to low-earning parents, thereby suggesting no evidence of borrowing constraints in the case of Canada. However, the problem with this approach is that since children's earnings depend on their ability as well as on human capital investment, they are likely to be endogenous to the presence of borrowing constraints (Black and Devereux 2011).

On the other hand, Mulligan (1997) uses the actual and expected receipt of inheritances to distinguish between "unconstrained" and "possibly constrained" groups and finds no difference in intergenerational earnings mobility between these groups using data on the United States (US), suggesting that borrowing constraints do not appear to be an important determinant of intergenerational mobility. By contrast, Gaviria (2002) uses slightly different criteria, namely the actual receipt of inheritances as well as the level of parents' wealth, to determine the likelihood of being credit constrained and finds that borrowing constraints do retard intergenerational mobility among constrained families.

Another strand of the literature examines more directly the role of parents' financial resources in the educational outcomes of children as well as in the intergenerational transmission of educational attainment.[8] The empirical evidence shows that the level of parents' financial resources is positively associated with children's outcomes. However, here as well a challenging task is to ascertain whether parents' investments in children's education, rather than families' underlying characteristics (e.g., cognitive and noncognitive abilities, preferences and aspirations for education, and family environment), are the main determinants of the formation of children's human capital.

In the case of the US, earlier work based on the 1979 National Longitudinal Survey of Youth (NLSY) finds that family income plays only a small role in college attendance decisions once adolescent ability, family background, and unobserved heterogeneity are

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[8] Lochner and Monge-Naranjo (2012) provide a useful review of previous studies on the impact of credit constraints on human capital accumulation.

controlled for (e.g., Cameron and Heckman 1998, 2001; Carneiro and Heckman 2002). Cameron and Heckman (1998), for instance, show that a substantial portion of the cross-sectional family income-schooling relationship is due to permanent family environmental factors, such as the level of permanent income and the host of factors that determine adolescent ability, rather than to short-term borrowing constraints. Carneiro and Heckman (2002) suggest that at most about 8% of youth in the US are subject to short-term liquidity constraints that affect their post-secondary schooling. Similarly, Cameron and Heckman (2001) find that the long-term factors associated with parental background and family environment, rather than short-term borrowing constraints faced by prospective students in college-going years, account for most of the racial-ethnic differences in college attendance. They thus conclude that most of the problem of disparity in educational attainment among racial, ethnic, and income groups arises at earlier stages of the life cycle of children.

Similar findings are obtained using the same data set by Keane and Wolpin (2001), who examine whether larger parental monetary transfers (from the age of 16 onward) by more educated parents account for a substantial part of the observed intergenerational correlation of educational attainment. They find that while some of the intergenerational correlation can be attributed to the larger college attendance contingent transfers made by more educated parents, borrowing constraints have little effect on school attendance itself. Keane and Wolpin (2001) explain this by showing that the relaxation of borrowing constraints merely induces children to work less and consume more while in college and hardly affects the college attendance decisions of children of less educated parents per se.

Note, however, that the review of more recent evidence by Lochner and Monge-Naranjo (2012) suggests that family income has recently become much more important for college attendance decisions than in the 1980s in the US. Lochner and Monge-Naranjo (2012) note that this reflects the significant rise in the costs of, and in returns to, college, which has increased the demand for credit well beyond the supply available from government programs. Indeed, Kubota (2016) shows that borrowing constraints on advancing to tertiary education have increased over time and that borrowing constraints impair intergenerational mobility in the US using data from the Preference Parameters Study, the US version of the survey data used for the present study.[9] His analysis also suggests that rising returns to education retard intergenerational mobility in the lower tail of the income

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[9] The Preference Parameters Study of Osaka University was conducted concurrently in China, India, Japan, and the US using almost identical survey instruments.

distribution.

In addition, Karagiannaki (2017) shows, using data on the United Kingdom (UK), that parents' housing wealth, which is more illiquid and reflects more closely the long-term effect of family background, is more strongly associated with the attainment of college-level qualifications than financial wealth, though the effect of financial wealth is estimated to be statistically significant at the lower end of the financial wealth distribution. This indicates that borrowing constraints may play an important role in college attendance decisions for some low-wealth, financially indebted families in the UK (Karagiannaki 2017).

In the case of Japan, we still lack empirical evidence on the role of borrowing constraints in the educational attainment of children.[10] Among the few studies that exist, Higuchi (1992) shows that the children of high-earning parents are more likely to enter highly ranked universities, which, in turn, leads to their earning a higher permanent income than the children of less wealthy parents. While his analysis is based on aggregate data, it suggests the possibility of the perpetuation of income inequalities across generations via education. On the other hand, Hojo (2008) looks at intergenerational income transfers by means of investment in education by examining the determinants of children's educational attainment using microdata on Japan. He finds that whether a child is an only child and whether a child has an elder brother affects his/her likelihood of advancing to tertiary education, suggesting that parents tend to make greater investments in older children's human capital, presumably due to their limited financial resources. This seems to suggest that borrowing constraints matter for intergenerational mobility. Hojo also looks at the effect of having attended private schools for pre-tertiary education on children's probability of attending college but finds its effect to be limited.

Nevertheless, the literature seems to predominantly exclude borrowing constraints as the main explanation for college attendance decisions, even in countries such as the US where the private cost of schooling is relatively high. To explain the lack of evidence on the role of borrowing constraints in determining college attendance, growing attention is being paid to the importance of human capital investment at early ages.[11] As noted earlier, Cameron and Heckman (2001) point out that while family income does matter, it has its

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[10] See Oshio and Senoh (2005) for a useful review of empirical studies on education in Japan, particularly the section on education and social stratification.

[11] See Heckman and Mosso (2014) for an overview of the importance of human capital investment at different stages of children's life cycle.

greatest influence on the formation of children's ability and readiness to enter college rather than on the financing of college education. They therefore argue that it is this long-term influence of family income and family background, as captured by children's ability or parental education, that best explains the observed correlation between college attendance and family income.

This explains why the effect of family income on college attendance becomes insignificant once adolescent ability, family background, and unobserved heterogeneity are controlled for (e.g., Cameron and Heckman 1998, 2001; Carneiro and Heckman 2002), as noted earlier. This, in turn, suggests that borrowing constraints at early ages might be more relevant than constraints at later ages for family investments in children's human capital. Moreover, the strong complementarity of investments at different stages of the life cycle of children implies that it may be difficult to compensate for the lack of early investment at later stages, and as a result, underinvestment at early ages is likely to have a more harmful and long-lasting effect on children's subsequent lives (Heckman and Mosso 2014; Restuccia and Urrutia 2004).

The important policy implication of these findings is that government policies that seek to reduce the strength of borrowing constraints at early ages are likely to be more effective in enhancing college attendance as well as intergenerational mobility while relaxing constraints for college expenses is likely to have a more limited impact (Restuccia and Urrutia 2004). However, it should be recognized that the dynamic complementarity of investments at different stages of the life cycle of children also implies that government subsidies for college expenses could induce increases in earlier investments and hence adolescent ability (Lochner and Monge-Naranjo 2012). Restuccia and Urrutia (2004), for instance, find that an income-based college subsidy policy is important in providing adequate incentives for poor families to invest in early education. Similarly, Caucutt and Lochner (2017) show that if parents anticipate a future income change when their children are young, the impacts of the change are more than twice as large. They therefore argue that quasi-experimental estimates of wealth/income effects on educational attainment using "exogenous" wealth/income shocks to the parents of adolescent children could lead to the impact of long-term differences in family income being underestimated because they ignore parents' early investment responses (Caucutt and Lochner 2017).

As this review of the relevant literature shows, the evidence on the importance of borrowing constraints for the intergenerational transmission of educational attainment is

mixed. We will try to fill this gap in the literature and shed light on the impact of borrowing constraints on intergenerational educational mobility by making use of unique information on which families were credit constrained for investments in their children's human capital.

4. Education System in Japan

The Basic Act on Education, which was enacted in 1947 and amended in 2006, set the principles of education policy in postwar Japan. It guarantees people's right to receive a free, compulsory education for nine years. Education policy is highly centralized at the national level in Japan and the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) is the administrative body responsible for it.

Figure 1. Percentage of Students Going on to Upper Secondary and Tertiary Education (%)
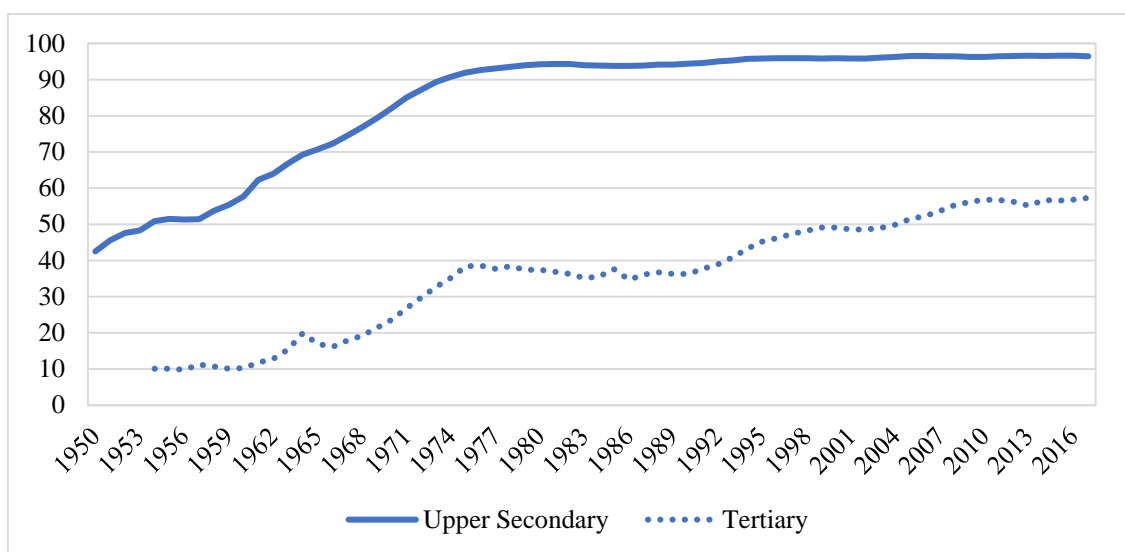
Note: These figures exclude those advancing to correspondence courses of upper secondary education and tertiary education, respectively. The figure for tertiary education indicates the number of students who enrolled in universities or junior colleges including those who completed upper secondary education in previous years as a percentage of those who graduated from lower secondary schools three years earlier. Source: School Basic Survey (Gakko Kihon Chosa) conducted by MEXT (available at http://www.e-stat.go.jp/SG1/estat/List.do?bid=000001015843&cycode=0).

The Japanese compulsory education system consists of six years of primary education and three years of lower secondary education.[12] Those who have completed compulsory

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[12] Note that preschool education is not part of compulsory education in Japan. There are three types of institutions that offer preschool education, namely kindergartens, daycare centers, and early childhood

education may go on to upper secondary education. Students are usually required to take entrance examinations to enter upper secondary schools. Upper secondary education is usually provided through full-time, part-time, or correspondence courses while the majority take full-time courses. If students attend full-time upper secondary schools, they normally complete upper secondary education within three years and some of them go on to tertiary education. In the case of Japan, tertiary education is provided by four-year universities, two-year junior colleges, and colleges of technology. Unlike universities or junior colleges, colleges of technology accept students who have completed lower secondary education and offer five-year programs.

Figure 1 shows the percentage of students going on to upper secondary and tertiary education since 1950. According to the latest statistics, about 96.4% of those who completed lower secondary education went on to upper secondary schools while about 57.3% went on to tertiary education in 2017. The percentage of students advancing to upper secondary education increased significantly, particularly in the 1950s and 1960s, and reached 90% in 1974. The trend for the percentage of students advancing to tertiary education is less clear, but there has been a steady increase over the past 50 years.

In Japan, both public and private institutions exist at all levels of education. As far as compulsory education is concerned, children are basically assigned to a public school based on their residence and the cost is free. Children also have the choice of attending a private school, which requires tuition fees. However, only about 1.2% and 7.2% of primary school and lower secondary school students, respectively, were enrolled in private schools, whereas about 31.9% of upper secondary school students and about 73.2% of students receiving tertiary education were enrolled in private institutions in 2017.[13]

Figure 2 shows the average per child annual expenditure of households on education by the level of schooling and type of schools children attend. As expected, parents spend a

education and care (ECEC) centers. Kindergartens are administered by MEXT and take children aged 3–5 and offer one- to three-year programs. By contrast, daycare centers operate under the jurisdiction of the Ministry of Health, Labour and Welfare (MHLW) and take children aged 0–5. These daycare centers are designed to take children whose parents or guardians cannot look after them at home due to work, illness, etc. ECEC centers are a new type of institution established since 2006 that perform the functions of both kindergartens and daycare centers to provide comprehensive preschool education (both early childhood education and care) to children aged 0-5. Unlike daycare centers, children are not required to be "lacking childcare" at home. The governing authorities of these centers are MEXT and MHLW.

[13] Based on the 2017 School Basic Survey (Gakko Kihon Chosa) conducted by MEXT (available at http://www.mext.go.jp/b_menu/toukei/chousa01/kihon/kekka/k_detail/1388914.htm).

significantly larger amount of money on children's education if they send their children to private schools. The difference between public and private schools is largest for primary education. It is also interesting to note that Japanese parents spend a relatively large amount of money on children's activities outside schools, including cultural and sports activities as well as cram schools, even if they send their children to public schools.

Figure 2. Per Child Annual Expenditure on Education
(2016, in 1,000 Japanese yen)
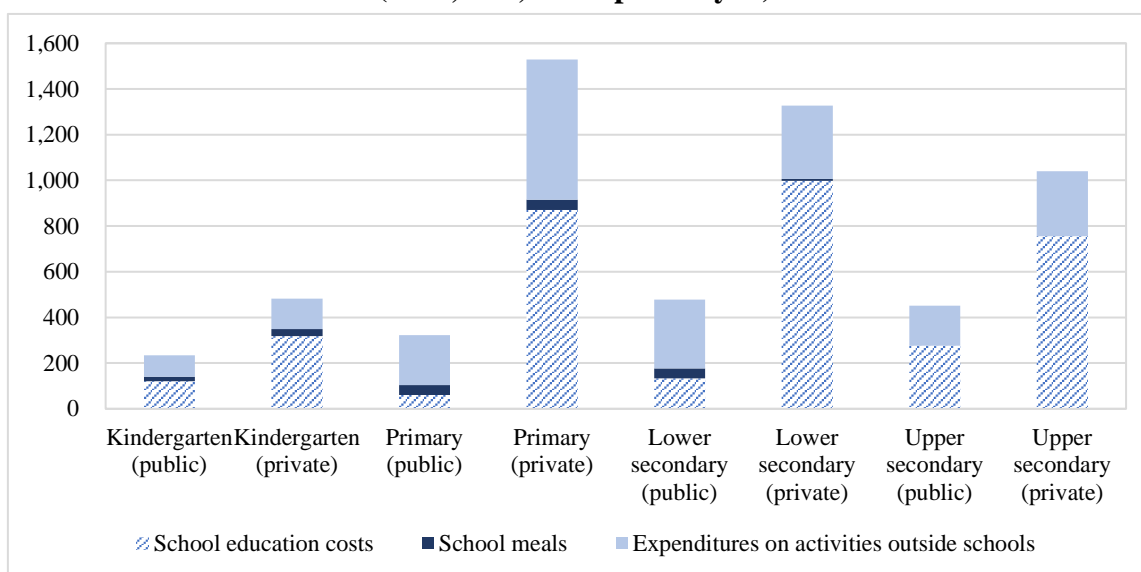
Note: Expenditure on upper secondary education pertains to students attending full-time schools.
Source: The 2016 Survey on Children's Education Expenses (Kodomono Gakushuhi Chosa) conducted by MEXT (available at http://www.mext.go.jp/b_menu/toukei/chousa03/gakushuuhi/kekka/k_detail/1399308.htm).

As far as tertiary education is concerned, student loans are provided through the Japan Student Services Organization (JASSO),[14] which was founded in 2004 by rearranging and integrating various programs, including the scholarship loan programs of the Japan Scholarship Foundation founded in 1943. JASSO provides student loans (interest-free as well as interest-bearing loans) to students who require financial assistance in order to pursue tertiary education. Eligibility for receiving these loans depends not only on parents' income level but also on students' academic performance at school. According to JASSO, one in every 2.6 students took out a loan in 2016, which is an increase from one in every 4.0 students in 2006.[15]

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[14] While "scholarship loans" is the official English translation used by JASSO, given that these loans need to be repaid in most cases, we use the word "student loans" in this paper instead to avoid misunderstanding.
[15] Based on information provided by JASSO (available at http://www.jasso.go.jp/about/ir/minkari/__icsFiles/afieldfile/2017/03/14/29minkari_ir.pdf).

Figure 3. Share of University Tuition Fees in Average Annual Household Income

One of the possible reasons behind this increase is the fact that household incomes have been steadily declining since 1994 in Japan, with 2014 real household income being only about 91% of the 1994 level.[16] This is because of the stagnation of the Japanese economy for the past two decades, the so-called Lost Two Decades, since the collapse of the asset bubble at the beginning of the 1990s. Despite this, tuition fees have remained high for both public and private universities. Figure 3 shows the share of annual tuition fees of both national and private universities in average annual household income since 1985. The graph illustrates that the share of university tuition fees in household income has been steadily increasing in Japan, particularly in the case of private universities, since the mid-1990s. As a result, it may not be so surprising to find an increase in students' reliance on student loans not only in terms of an increase in the share of students taking out loans but also in terms of the share of loans in students' income. For students attending four-year universities, student loans used to comprise about 5.7% of their total annual income in 1996, but their share had increased to 20.3% in 2016. By contrast, the share of family

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[16] Based on data on household income from the Comprehensive Survey of Living Conditions conducted by MHLW (available at http://www.mhlw.go.jp/toukei/list/20-21.html).

contributions decreased from 75.6% to 60.6% during the same period.[17]

It would be interesting to see whether such trends have any bearing on the effect of borrowing constraints on intergenerational educational mobility.

5. Data and Estimation Methods

5.1 Data

The data used for the empirical analysis come from the "Preference Parameters Study" of Osaka University. This survey was conducted annually in Japan during the 2003–13 period by the 21st Century Center of Excellence (COE) Program "Behavioral Macrodynamics Based on Surveys and Experiments" and the Global COE Project "Human Behavior and Socioeconomic Dynamics" of Osaka University. A sample of individuals aged 20–69 was drawn to be nationally representative using two-stage stratified random sampling. The sample has a panel component, although fresh observations were added in 2004, 2006, and 2009 to overcome the problem of attrition.

Given that data from the Preference Parameters Study contain information not only on respondents' educational attainment but also on that of their parents, the data are well suited for analyzing intergenerational educational mobility. Data from the 2012 wave (4,588 observations in total) are mainly used for the present analysis as they contain unique information on whether respondents have ever given up schooling for financial reasons. In other words, the data allow us to identify exactly which families faced borrowing constraints for their children's education. The 2012 wave also includes other useful questions, such as those on respondents' mothers' presence in the household when respondents were 3, 7, and 15 years old, respectively. We also make use of information on respondents and their families when respondents were 15 years old from the 2009 wave, namely the number of respondents' siblings, the standard of living of their families, the prefecture of their residence, and their academic performance.

The age of respondents in the 2012 wave ranges from 22 to 78. We restrict our estimation

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[17] These figures are based on information provided by JASSO (available at http://www.jasso.go.jp/about/ir/minkari/__icsFiles/afieldfile/2017/03/14/29minkari_ir.pdf). Note that the average annual income of four-year university students was about 2.1 million yen in 1996 (about US$ 19,000 at the rate of US$1 = 110 yen) and about 2.0 million yen (about US$ 18,000) in 2016, according to JASSO.

sample to respondents who were born after World War II. In addition, we drop respondents who said that they were still students in 2012. After excluding observations with missing information on the variables used in our analysis, we are left with 3,012 observations. We then divide the remaining observations into three cohorts, more specifically respondents born between 1946 and 1960 (Cohort I), between 1961 and 1975 (Cohort II), and between 1976 and 1989 (Cohort III), in order to see whether there have been any changes in intergenerational educational mobility over time. This grouping of the sample is based on trends in the percentage of students advancing to tertiary education: Cohorts I and III correspond to the generations with an upward trend in the advancement rate (with Cohort I showing a more pronounced upward trend) while Cohort II corresponds to the generation with a stagnant advancement rate. Note that these trends correspond to the year when respondents were 15 years old.

5.2 Estimation Methods

To examine the intergenerational transmission of educational attainment, we estimate the following standard equation using ordinary least squares (OLS):

$$Y_{ic} = \alpha + \beta Y_{ip} + \gamma X_i + \varepsilon_i \tag{1}$$

where Y_{ic} and Y_{ip} represent the years of schooling completed by child c and parent p of family i, respectively. X_i is a vector of variables representing the characteristics of the child and his/her family, and ε_i is an error term. β is the parameter of interest and indicates the extent of the intergenerational persistence of educational attainment. A greater absolute value of β implies that children's schooling is more heavily influenced by their parents' schooling while a value close to 0 implies that children's schooling tends to be independent of their parents' schooling.

Note that the estimated $\hat{\beta}$ is given by:

$$\hat{\beta} = \rho_{cp} \frac{\sigma_c}{\sigma_p} \tag{2}$$

where σ_c and σ_p are the standard deviations of children's and parents' years of schooling, respectively, and ρ_{cp} is the correlation between children's and parents' years of schooling. Equation (2) implies that an increase (decrease) in the estimated intergenerational

persistence of educational attainment $\hat{\beta}$ may simply be the result of an increase (decrease) in the dispersion of children's schooling relative to the dispersion of parents' schooling (Checchi, Fiorio, and Leonardi 2013; Hertz *et al*. 2007). Hence, we also estimate the following equation whereby we normalize children's and parents' years of schooling by the corresponding standard deviations:

$$\frac{Y_{ic}}{\sigma_c} = \delta + \rho \frac{Y_{ip}}{\sigma_p} + \tau X_i + \varepsilon_i \tag{3}$$

The coefficient β therefore takes into account changes in the dispersion of educational outcomes in children's and parents' generations, providing a relative measure of intergenerational persistence. On the other hand, the coefficient ρ provides an absolute measure of intergenerational persistence, which is adjusted for changes in the distribution of educational attainment from one generation to the next. We estimate both equations (1) and (3) and report both measures of the intergenerational persistence of educational attainment.

Our dependent variable is children's (i.e., respondents' in this case) years of schooling and the main explanatory variable of interest is parents' years of schooling. For parents' years of schooling, we use the average of fathers' and mothers' years of schooling. If the effects of mothers' and fathers' schooling do not differ from one another, the estimated coefficient on this variable should equal the total effect of a one-year increase in both parents' years of schooling in a model where both parents' schooling are included simultaneously. This restricted model has the advantage of controlling for assortative mating and avoiding multicollinearity (Holmlund, Lindahl, and Plug, 2011). Nevertheless, since it is possible that fathers' and mothers' education affects children's educational attainment differently, we also try including both fathers' and mothers' years of schooling simultaneously as a robustness check. Given that information on educational attainment is reported as categorical variables based on the completion/incompletion of various academic qualifications in the Preference Parameters Study, we calculate years of schooling as the minimum length of time required to obtain a particular qualification for both children and parents.

As noted earlier, the 2012 wave of the Preference Parameters Study includes questions asking respondents whether they have ever given up schooling for financial reasons, and if they have, which level of schooling (upper secondary school, college of technology,

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two-year junior college, university, or graduate school) they have forgone. It is therefore possible to identify which respondents were credit constrained for their education and how much schooling they could have received if they had not faced borrowing constraints. Using this unique information, we recalculate respondents' years of schooling assuming that nobody faced borrowing constraints.[18] We then re-estimate equation (1) based on this version of our dependent variable and compare the estimates of β to assess the importance of borrowing constraints for the intergenerational transmission of educational attainment. Theory predicts that intergenerational educational mobility would be lower in a society with borrowing constraints given that some parents would not be able to invest in children's human capital at the optimal level. We therefore expect our estimate of β to be greater when we use the original data on children's years of schooling than when we use the hypothetical number of years of schooling for children who had to give up schooling for financial reasons on the assumption that nobody had faced borrowing constraints. This is a more direct assessment of the importance of borrowing constraints for intergenerational educational mobility than previous attempts made in the literature.

As illustrated above, respondents are considered to have faced borrowing constraints in the present analysis if they have ever given up their schooling for financial reasons. As a result, "borrowing constraints" are defined in a relatively broad sense here, and are not restricted to a situation in which respondents or their parents were not able to borrow to finance respondents' education. Moreover, the self-reporting nature of the question poses some limitations to accurately identifying families facing borrowing constraints for children's education. Nevertheless, when we analyze the determinants of the likelihood of facing borrowing constraints, we obtain reasonable results with most coefficients having the expected signs, as shown below. While we acknowledge the limitation of using responses to the self-reported questions in this analysis, we take some comfort from these findings.

As far as the other explanatory variables are concerned, we include respondents' characteristics, namely their gender and their academic performance when they were 15 years old. Respondents are asked to indicate how high/low their grades (i.e., low, relatively low, middle, relatively high, or high) were relative to others in their grade for all subjects, Japanese, and mathematics. We construct a categorical variable that indicates

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[18] We calculate the lower bound of the hypothetical number of years of schooling assuming, for example, that respondents went only to upper secondary school if they said that they gave up going to upper secondary school for financial reasons (i.e., we assume that they did not go on to university in this case).

the relative rank of respondents' grades for all subjects. This variable can be interpreted as the academic ability of respondents when they were adolescents.

We also include four measures of family background using information on respondents' families when respondents were 15 years old: (i) a variable that indicates whether the respondent was the eldest son in the family; (ii) the number of siblings the respondent had; (iii) a variable that indicates whether the mother was absent from the household (i.e., divorced or died); and (iv) the standard of living of the respondent's family. The latter is based on respondents' answers to a question asking them to indicate their relative standard of living during their childhood on a scale of 0–10, with 10 being "wealthiest" and 0 being "poorest." We treat this variable as being cardinal. Given that the family's standard of living is likely to reflect permanent income more than short-term liquidity constraints, including this variable in the estimation model allows us to examine the effect of permanent income on children's educational attainment, at least to some extent.

We additionally include respondents' cohort fixed effects (5-year intervals) to control for cohort trends in education as well as regional fixed effects based on the prefecture of respondents' residence when they were 15 years old to allow for differences in geographical characteristics. We also include cohort fixed effects (15-year intervals) for respondents' fathers and mothers. Finally, we include a variable that indicates the annual average ratio of active job openings to applicants in the year in which respondents were 18 years old to reflect the economic situation around the time respondents considered going to university.[19]

Note that the estimated intergenerational transmission of educational attainment in this analysis should be regarded as a descriptive measure of intergenerational association in educational attainment rather than as a measure of the causal effect of parents' education on children's education. The behavior and decisions of children may be affected by the unobserved characteristics of parents, such as genes, preferences, and/or family environment. As a result, OLS estimates are potentially biased upwards. Unfortunately, we lack the data needed to implement appropriate identification strategies that would allow us to disentangle these effects and identify a causal mechanism that underlies the relationship between parents' and children's educational attainment. The coefficients we estimate should therefore be interpreted as a combination of all of these effects. We leave

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[19] Data on the active job openings to applicants ratio are from statistics on Employment Referrals for General Workers collected by MHLW (available at http://www.mhlw.go.jp/toukei/list/114-1.html).

the examination of the causal relationship underlying the intergenerational transmission of educational attainment as an agenda for future research.

Table 1. Descriptive Statistics

	Cohort I (1946–1960)		Cohort II (1961–1975)		Cohort III (1976–1989)	
	mean	s.d.	mean	s.d.	mean	s.d.
Children's characteristics						
Years of schooling	13.20	2.09	13.63	1.90	14.02	1.94
Female	0.53		0.56		0.61	
Academic performance at age 15						
Low rank	0.05		0.06		0.08	
Relatively low rank	0.09		0.14		0.15	
Middle	0.37		0.36		0.38	
Relatively high rank	0.31		0.30		0.24	
High rank	0.19		0.14		0.15	
Gave up schooling for financial reasons	0.15		0.10		0.08	
Hypothetical number of years of schooling	13.67	2.04	13.93	1.91	14.23	1.95
Parents' characteristics						
Average years of schooling	10.48	1.76	11.38	1.88	12.53	1.83
Father's years of schooling	10.63	2.28	11.59	2.42	12.66	2.50
Mother's years of schooling	10.33	1.63	11.18	1.78	12.41	1.69
Family background at age 15						
Eldest son	0.17		0.21		0.19	
Number of siblings	2.15	1.43	1.44	0.82	1.49	0.75
Standard of living	4.65	1.73	5.12	1.84	5.48	1.68
No mother (divorced or died)	0.02		0.01		0.02	
Job openings to applicants ratio	0.97	0.35	0.84	0.27	0.66	0.14
No. of observations	1,349		1,265		398	

s.d. = standard deviation
Source: Calculations based on data from the 2009 and 2012 Preference Parameters Study.

6. Empirical Results

6.1 Descriptive Statistics

Table 1 shows summary statistics for the dependent and explanatory variables used in the empirical analysis, separately for each cohort. The table shows that there has been an increase in the years of schooling completed by parents and children (i.e., respondents) over time. While our variable that indicates the standard of living of children's families when children were 15 years old is essentially a relative term, the number of children who

feel that their standard of living was relatively high seems to have increased over time as well. At the same time, the proportion of children who gave up schooling for financial reasons declined, from about 15% for Cohort I to about 8% for Cohort III. This may be partly due to the increase in the standard of living of children's families, but it may also be partly due to the steady decline in the number of siblings children have, as shown in the table.

Carneiro and Heckman (2002) estimate that at most about 8% of youth in the US are subject to short-term liquidity constraints that affect their post-secondary schooling using data from the 1979 NLSY. For those who were born in the same period as that Carneiro and Heckman (2002) looked at,[20] the percentage of children who gave up going to a four-year university or a two-year junior college is calculated to be about 9.4%. Although this figure is for Japan, the percentage of children who gave up tertiary education for financial reasons seems relatively similar in Japan and the US.

Figure 4. Proportion of Children Who Gave Up Schooling for Financial Reasons by Level of Schooling
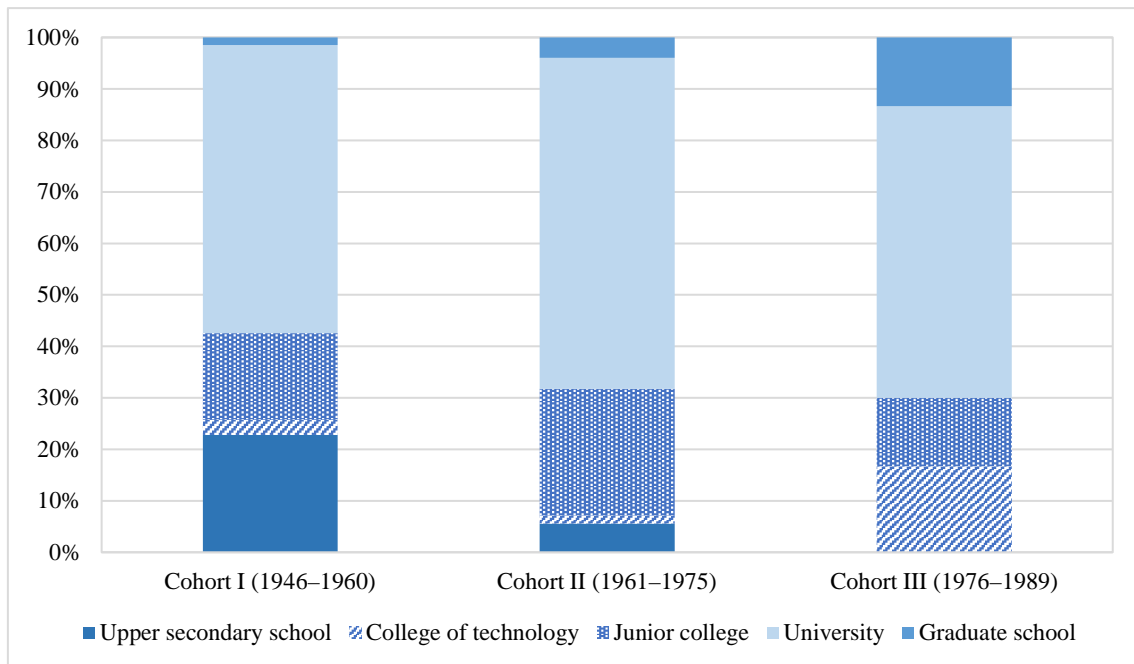
Source: Calculations based on data from the 2012 Preference Parameters Study.

Figure 4 shows the level of schooling children gave up for financial reasons for each cohort. Although more than half of the children who were credit constrained gave up

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[20] Those who were born between the years 1957 and 1964 were surveyed in the 1979 NLSY.

going to university in all three cohorts, there are some differences across cohorts in the level of schooling children gave up. The percentage of children who did not go to upper secondary school for financial reasons was relatively high (22.8%) for Cohort I, but no-one gave up going to upper secondary school for financial reasons in Cohort III. By contrast, there was an increase in the percentage of children who did not go to graduate school for financial reasons from 1.5% for Cohort I to 13.3% for Cohort III. Figure 4 thus suggests that borrowing constraints used to bind more at lower educational levels for older cohorts than for younger cohorts. Nevertheless, Table 1 shows that the hypothetical number of years of schooling, assuming that nobody faced borrowing constraints, is consistently greater than the years of schooling children actually completed for all three cohorts.

6.2 Mobility Indices

Before moving on to our regression analysis, we first examine intergenerational educational mobility based on transition matrices. Table 2 presents the matrices of transition among four education categories defined based on years of schooling: (i) equal to or less than 9 years (up to lower secondary education); (ii) more than 9 but equal to or less than 12 years (up to upper secondary education); (iii) more than 12 but less than 16 years (some tertiary education); and (iv) equal to or more than 16 years (at least four-year university degree).

A 4 x 4 transition matrix P is computed based on the four categories of educational outcomes, as described above, for parents and children of each cohort. The elements of the matrix are p_{ij}, which represent the probabilities that educational outcomes move from category i in parents' generation to category j in children's generation. To assess how mobility has changed over time, we calculate two types of mobility indices: (i) the mobility index proposed by Shorrocks (1978) and (ii) the average jump index proposed by Bartholomew (1973).

Shorrocks' (1978) mobility index is defined as:

$$M_S = \frac{k - trace(P)}{k-1} \tag{4}$$

where P is a transition matrix with k educational categories and trace(P) is the sum of the

elements of the main diagonal of P. This index ranges from 0 (zero mobility) to 1 (perfect mobility). The computed indices are shown in Table 2. We find that educational mobility increased from 0.784 to 0.845 between Cohort I and Cohort III, as the percentage of children whose educational attainment was the same as their parents' declined over time.

Table 2. Transition Probability Matrices and Mobility Indices by Birth Cohort

	Children				Mobility index (Shorrocks)	Average Jump Index
Parents	<=9	>9 and <=12	>12 and <16	>=16		
Cohort I (1946–1960)						
<=9	0.10	0.63	0.12	0.14	0.784	1.009
>9 and <=12	0.03	0.48	0.22	0.28		
>12 and <16	0.02	0.15	0.28	0.55		
>=16	0.00	0.13	0.08	0.79		
Cohort II (1961–1975)						
<=9	0.02	0.68	0.18	0.12	0.831	0.910
>9 and <=12	0.01	0.46	0.27	0.26		
>12 and <16	0.00	0.19	0.30	0.51		
>=16	0.00	0.06	0.21	0.73		
Cohort III (1976–1989)						
<=9	0.00	0.82	0.09	0.09	0.845	0.804
>9 and <=12	0.01	0.41	0.28	0.30		
>12 and <16	0.00	0.25	0.28	0.46		
>=16	0.00	0.00	0.23	0.77		

Source: Calculations based on data from the 2012 Preference Parameters Study.

However, one of the drawbacks of Shorrocks' mobility index is that it is insensitive to any moves other than those on the diagonal. As a complementary measure, we also calculate the "average jump" index proposed by Bartholomew (1973), which addresses this issue by taking into account movements off the diagonal. It is defined as:

$$M_B = \sum_i^k \sum_j^k p_{i.} p_{ij} |i - j| \tag{5}$$

where p_{ij} is the value of the element in row i and column j and $p_{i.}$ is the marginal distribution of educational category i for parents' generation. Their product is multiplied by the distance between the two educational categories. The average jump index shows that educational mobility decreased throughout the postwar period, a trend opposite to that shown by Shorrocks' mobility index. Table 2 shows, for example, that among those whose parents did not go to upper secondary school, the percentage of children obtaining a four-year university or higher degree declined during this period. This seems to suggest

the persistence (or worsening) of educational inequality across generations over time.

Table 3. Mobility Indices by Gender of Parents and Children

	All children		Sons		Daughters	
	Mobility index (Shorrocks)	Average Jump Index	Mobility index (Shorrocks)	Average Jump Index	Mobility index (Shorrocks)	Average Jump Index
Parents						
Cohort I	0.784	1.009	0.807	1.205	0.786	0.837
Cohort II	0.831	0.910	0.872	1.058	0.794	0.795
Cohort III	0.845	0.804	0.913	0.873	0.789	0.759
Father						
Cohort I	0.885	1.117	0.874	1.289	0.886	0.965
Cohort II	0.924	1.015	0.906	1.103	0.950	0.947
Cohort III	0.878	0.935	0.931	0.975	0.846	0.909
Mother						
Cohort I	0.814	1.156	0.748	1.343	0.874	0.992
Cohort II	0.867	1.066	0.887	1.224	0.836	0.943
Cohort III	0.887	0.910	0.930	0.962	0.862	0.875

Source: Calculations based on data from the 2012 Preference Parameters Study.

In order to see whether these observed trends in mobility differ depending on the gender of parents and/or children, we calculate both types of mobility indices for all possible combinations of parents and children, as shown in Table 3. As far as Shorrocks' mobility index is concerned, we consistently observe an increase in intergenerational educational mobility for sons regardless of whether we consider the educational attainment of their parents, mothers, or fathers as the base level. By contrast, intergenerational educational mobility increased, then decreased in the case of parents to daughters and fathers to daughters, while the opposite trend is observed in the case of mothers to daughters. Nevertheless, as pointed out earlier, Shorrocks' mobility index does not capture moves other than those along the diagonal. We therefore also need to look at the average jump index in order to see the full picture. In this case, we consistently observe a decline in educational mobility for all the combinations during the postwar period. This raises a serious concern for Japan, even though the country has managed to increase the general educational level of the population over time.

If we compare the average jump index between sons and daughters, we find that mobility tends to be greater for sons than for daughters. It is also found to be greater if we use the educational attainment of mothers instead of that of fathers as the base level, presumably because of the relatively low level of educational attainment among women. However, the fact that mobility tends to be relatively low if we use the educational attainment of

both parents instead of that of fathers or mothers as the base level suggests that assortative mating is having an impact on intergenerational educational mobility.

6.3 Regression Results

Intergenerational Transmission of Educational Attainment

To further analyze the intergenerational transmission of educational attainment, we turn to a regression analysis of the determinants of children's years of schooling. Table 4 reports the OLS regression results of equation (1). We first regress children's years of schooling on parents' years of schooling along with basic variables, namely a female dummy, the job openings to applicants ratio, regional fixed effects, and cohort fixed effects for children as well as for their fathers and mothers. We then add variables that reflect family background when children were 15 years old, namely whether the child is the eldest son, the number of siblings, the relative standard of living, and mother's presence. We then further add variables that indicate how well children performed academically at school when they were 15 years old.

We first compare the adjusted R^2 of different variants of regressions for each cohort to assess the importance of family background and of children's ability when they were adolescents as determinants of children's years of schooling. While adding a set of variables relating to family background increases the adjusted R^2 by about 28% for Cohorts I and III, it increases it by only about 8% for Cohort II. This suggests that the relative importance of family background for children's educational attainment declined initially, then increased anew.

If we look at individual coefficients, the penalty for having a larger number of siblings is found to have declined initially (became insignificant), then increased anew. As for the penalty for growing up in a household with a relatively low level of standard of living, it seems to have become less important for Cohorts II and III compared to the case for Cohort I. If we consider the standard of living variable as a proxy for permanent income, the regression results suggest that the family's permanent income is still an important determinant of the child's educational attainment for all cohorts but that its relative importance seems to have declined over time to some extent. The cost of growing up in a broken family (the mother is absent) is also observed mainly among older cohorts.

As far as adolescent academic ability is concerned, it is found to be an important determinant of children's educational attainment for all cohorts, which is consistent with previous studies (e.g., Cameron and Heckman 1998, 2001; Carneiro and Heckman 2002). Moreover, unlike family background, the importance of adolescent ability is found to have increased for younger cohorts. Simply adding the adolescent ability variable increases the adjusted R^2 further by about 43% for Cohort I, but it increases it even more, by about 78% and 88%, for Cohorts II and III. In other words, how well children performed when they were 15 years old seems to play a greater role in determining their subsequent educational attainment today than in the past, thereby suggesting the increasing importance of investments in children's human capital at earlier ages.[21]

Even after controlling for family background as well as for children's academic ability when they were adolescents, we still find a significant association between parents' and children's schooling, as found in the literature. It is, however, more disturbing to find that the extent of the intergenerational transmission of educational attainment seems to have remained high throughout this period, even though there has been a steady increase in the level of educational attainment in postwar Japan.

To examine whether the persistence of the relatively high degree of the intergenerational transmission of educational attainment is due to changes in the dispersion of children's schooling relative to the dispersion of parents' schooling, we also estimate equation (3), in which we normalize children's and parents' years of schooling by the corresponding standard deviations. We include a full set of explanatory variables in the equation, and the relevant results are shown in Table 5.[22]

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[21] Note, however, that the observed increase in the importance of adolescent academic ability for children's subsequent educational attainment may also be due to an increase in the importance of "residual" ability not explained by other explanatory variables. This may be caused by, for example, increased heterogeneity in school quality. Due to the lack of data on the quality of schools that children attended, a further investigation of this point is left for future research. However, I would like to thank Tomoki Fujii for drawing my attention to this very important point.

[22] The full regression results are available from the author upon request.

Table 4. Regression Results for the Determinants of Children's Years of Schooling

	Cohort I (1946–1960)			Cohort II (1961–1975)			Cohort III (1976–1989)		
Parents' years of schooling	0.413***	0.335***	0.265***	0.393***	0.370***	0.300***	0.376***	0.356***	0.292***
	[0.030]	[0.030]	[0.028]	[0.027]	[0.027]	[0.025]	[0.053]	[0.052]	[0.049]
Family background at age 15									
Eldest son		0.010	0.027		0.181	0.078		0.061	-0.177
		[0.160]	[0.148]		[0.152]	[0.137]		[0.300]	[0.276]
Number of siblings		-0.274***	-0.225***		-0.033	-0.010		-0.392***	-0.368***
		[0.041]	[0.038]		[0.062]	[0.056]		[0.124]	[0.114]
Standard of living		0.195***	0.159***		0.080***	0.048*		0.116**	0.089*
		[0.030]	[0.028]		[0.028]	[0.025]		[0.056]	[0.051]
No mother (divorced or died)		-1.151***	-1.160***		-1.595***	-0.964**		1.502*	1.142
		[0.401]	[0.370]		[0.449]	[0.408]		[0.766]	[0.706]
Children's characteristics									
Female	-0.841***	-0.959***	-0.936***	-0.542***	-0.473***	-0.477***	-0.117	-0.095	-0.100
	[0.102]	[0.116]	[0.108]	[0.098]	[0.123]	[0.111]	[0.191]	[0.233]	[0.213]
Academic performance at age 15 (base category: middle)									
Low rank			-0.319			-0.856***			-0.109
			[0.229]			[0.190]			[0.326]
Relatively low rank			-0.612***			-0.564***			-0.437*
			[0.172]			[0.139]			[0.253]
Relatively high rank			0.835***			0.838***			0.770***
			[0.112]			[0.109]			[0.220]
High rank			1.636***			1.668***			1.959***
			[0.130]			[0.139]			[0.259]
Job openings to applicants ratio	-0.087	-1.98E-04	-0.019	-0.044	-0.096	-0.164	-0.004	-0.489	-0.476
	[0.236]	[0.228]	[0.211]	[0.325]	[0.324]	[0.293]	[1.387]	[1.373]	[1.257]
Constant	9.362***	10.239***	10.432***	9.262***	9.152***	9.460***	9.348***	9.927***	9.452***
	[0.424]	[0.457]	[0.423]	[1.072]	[1.092]	[0.993]	[1.632]	[1.623]	[1.493]
Adjusted R^2	0.202	0.259	0.370	0.177	0.190	0.338	0.126	0.161	0.303
No. of observations	1,349	1,349	1,349	1,265	1,265	1,265	398	398	398

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels. Standard errors are in parentheses. Regional and cohort dummies are included in all regressions.

Source: Estimation based on data from the 2009 and 2012 Preference Parameters Study.

Table 5. Relative and Absolute Measures of Intergenerational Persistence in Educational Attainment

	Cohort I (1946–1960)	Cohort II (1961–1975)	Cohort III (1976–1989)
β (relative)	0.265*** [0.028]	0.300*** [0.025]	0.292*** [0.049]
ρ (absolute)	0.223*** [0.024]	0.297*** [0.025]	0.276*** [0.046]
No. of observations	1,349	1,265	398

Note: *** denotes statistical significance at the 1% level. Standard errors are in parentheses.
Source: Estimation based on data from the 2009 and 2012 Preference Parameters Study.

The estimated ρ tends to be smaller than the estimated β for all cohorts given that the dispersion of children's years of schooling is greater than that of parents' years of schooling for all cohorts (see Table 1). Nevertheless, even if we take into account differences in the dispersion of years of schooling between children's and parents' generations, we still observe that the degree of the intergenerational transmission of educational attainment has remained high during this period.

Hertz *et al*. (2007) show that the global average correlation between parents' and children's schooling has remained at about 0.4 (0.39 for Asian countries) for the past 50 years. If we estimate equation (3) with only parents' years of schooling and cohort fixed effects as explanatory variables for the entire sample, the correlation is estimated to be about 0.37. While it is difficult to make a direct comparison of this figure with the results obtained by Hertz *et al*. (2007) due to the use of different data sets, etc., it seems that the extent of the intergenerational transmission of educational attainment for Japan is roughly equal to the global average.

Table 6. The Effect of Fathers' and Mothers' Years of Schooling on Children's Educational Attainment

	Cohort I (1946–1960)	Cohort II (1961–1975)	Cohort III (1976–1989)
(1) Father's years of schooling	0.142*** [0.026]	0.156*** [0.023]	0.146*** [0.040]
(2) Mother's years of schooling	0.117*** [0.036]	0.140*** [0.031]	0.147** [0.060]
(1) = (2)	$F(1, 1321) = 0.21$	$F(1, 1236) = 0.11$	$F(1, 369) = 0.00$
	p value = 0.643	p value = 0.739	p value = 0.986
No. of observations	1,349	1,265	398

Note: *** denotes statistical significance at the 1% level. Standard errors are in parentheses.
Source: Estimation based on data from the 2009 and 2012 Preference Parameters Study.

We have so far used the average of fathers' and mothers' years of schooling for parents' years of schooling on the assumption that the effects of mothers' and fathers' schooling

do not differ from one another. It is, however, possible that fathers' and mothers' education affect children's educational attainment differently. We therefore try including both fathers' and mothers' years of schooling simultaneously and the relevant results are shown in Table 6.[23] The coefficients on fathers' and mothers' years of schooling are both highly significant, and it is interesting to note that the association between mothers' and children's years of schooling seems to have become greater for younger cohorts. Nevertheless, we could not reject the equality of the coefficients on fathers' and mothers' years of schooling for all cohorts. We also run the same regression separately for the male and female samples, but we could not reject the equality of these coefficients either. We thus use the average of fathers' and mothers' years of schooling for the rest of the paper.

Role of Borrowing Constraints

One of the main objectives of this paper is to assess the importance of borrowing constraints for the intergenerational transmission of educational attainment. Since we have unique information on which families were credit constrained for investments in children's education and at which level of schooling they were credit constrained, we re-estimate the intergenerational transmission of educational attainment assuming that these children did not have to give up schooling for financial reasons.

Table 7. Role of Borrowing Constraints in Determining Intergenerational Educational Mobility

	Cohort I (1946–1960)	Cohort II (1961–1975)	Cohort III (1976–1989)
(1) With borrowing constraints	0.265*** [0.028]	0.300*** [0.025]	0.292*** [0.049]
(2) Without borrowing constraints	0.224*** [0.029]	0.264*** [0.025]	0.286*** [0.051]
(1) = (2)	$\chi^2 (1) = 5.63$	$\chi^2 (1) = 7.17$	$\chi^2 (1) = 0.09$
	p value = 0.018	p value = 0.007	p value = 0.768
No. of observations	1,349	1,265	398

Note: *** denotes statistical significance at the 1% level. Standard errors are in parentheses.
Source: Estimation based on data from the 2009 and 2012 Preference Parameters Study.

Table 7 reports the estimates of β for the case where some families were credit constrained (i.e., the results based on the original data, which are the same as those reported in Table 4) and for the case where nobody faced borrowing constraints.[24] A comparison of the estimates of β indicates that borrowing constraints seem to have been significant enough

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[23] The full regression results are available from the author upon request.
[24] The full regression results are available from the author upon request.

to strengthen the intergenerational transmission of educational attainment, i.e., to lower intergenerational educational mobility, for Cohorts I and II, but that they do not seem to have a significant effect for Cohort III. In other words, the role of borrowing constraints in determining intergenerational educational mobility seems to have weakened over time. This seems to be in line with our earlier finding that there has been a steady decline in the percentage of children who gave up schooling for financial reasons in recent decades.

Table 8. Determinants of Facing Borrowing Constraints (average marginal effects)

	Cohort I (1946–1960)	Cohort II (1961–1975)	Cohort III (1976–1989)
Parents' years of schooling	-0.012* [0.006]	-0.013*** [0.005]	-0.007 [0.008]
Family background at age 15			
Eldest son	0.007 [0.032]	0.021 [0.027]	-0.001 [0.042]
Number of siblings	0.025*** [0.007]	0.008 [0.010]	0.035** [0.017]
Standard of living	-0.035*** [0.006]	-0.020*** [0.005]	-0.033*** [0.010]
No mother (divorced or died)	0.178*** [0.061]	0.050 [0.065]	0.013 [0.111]
Children's characteristics			
Female	0.059** [0.022]	0.024 [0.022]	-0.014 [0.032]
Academic performance at age 15 (base category: middle)			
Low rank	0.005 [0.041]	-0.019 [0.035]	0.058 [0.058]
Relatively low rank	0.050 [0.035]	-0.039 [0.024]	0.022 [0.040]
Relatively high rank	0.037 [0.023]	-0.023 [0.021]	0.034 [0.037]
High rank	0.045 [0.028]	0.008 [0.029]	-0.026 [0.034]
Job openings to applicants ratio	0.002 [0.044]	-0.079 [0.056]	0.056 [0.200]
Pseudo R^2	0.105	0.062	0.111
No. of observations	1,349	1,265	398

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels. Standard errors are in parentheses. Regional and cohort dummies are included in all regressions.
Source: Estimation based on data from the 2009 and 2012 Preference Parameters Study.

In order to investigate why we observe such trends, we also examine the determinants of whether children gave up schooling for financial reasons by estimating a probit model. The results are shown in terms of average marginal effects in Table 8.

The regression results show that the probability of facing borrowing constraints is negatively and significantly associated with parents' years of schooling for Cohorts I and II only. Having less educated parents used to increase children's probability of being credit constrained, but this cost of having less educated parents seems to have become attenuated for the youngest cohort. This may explain why we find that borrowing constraints lost their importance for intergenerational educational mobility for the youngest cohort we examined in this paper.

As far as the rest of the regression results are concerned, the probability of being credit constrained is negatively and significantly associated with the relative standard of living of their families when children were adolescents, as expected. We also find that the probability of being credit constrained is positively and significantly associated with the number of siblings children have, as expected, though the average marginal effect of the number of siblings is not significant for Cohort II. Finally, it is encouraging to find that the penalty for being female and for growing up in a broken family (the mother is absent) is no longer observed in younger cohorts. Unfortunately, we do not have information on whether the father was present in the household when the child was growing up. Given the increasing number of single mothers in recent years in Japan, examining the implication of growing up in a single-mother household for children's likelihood of facing borrowing constraints for schooling, for their educational attainment as well as for intergenerational educational mobility is left as an important agenda for future research.

6.4 Discussion

As described earlier, Japan has seen a significant increase in the percentage of children going on to upper secondary education, and almost everyone does so today. Although to a lesser extent, there has also been a steady increase in the percentage of children advancing to tertiary education in Japan. Nevertheless, our regression analysis indicates that, concurrent with this upward trend, the extent of the intergenerational transmission of educational attainment has remained high, thereby suggesting that there has not been any increase in intergenerational educational mobility during the postwar period in Japan.

However, in line with the decline in the percentage of children giving up schooling for financial reasons over time, the regression results indicate that the borrowing constraints some families faced were significant enough to lower intergenerational educational mobility only for older cohorts and that they no longer mattered for the youngest cohort we examined in this analysis. In other words, borrowing constraints are no longer an obstacle for enhancing intergenerational educational mobility, at least in the case of Japan. We therefore need to look for elsewhere for the reasons for why the degree of the intergenerational persistence of educational attainment has not declined even though the general level of educational attainment has increased in postwar Japan.

While the importance of being female and that of family background, such as the standard

of living of the child's family or belonging to a broken family (mother's absence from the household), for educational attainment has declined during the postwar period in Japan, the regression results provide some indication that the relative importance of adolescent academic ability has increased instead. While such ability is partly passed on genetically from parents or nurtured through the family environment, it also reflects, at least partly, earlier investments that parents made in their children, as emphasized by Cameron and Heckman (1998, 2001). The fact that the relative importance of adolescent academic ability has increased over time suggests that its increase is likely to have been driven at least partly by the increased importance of investments in children at earlier ages (unless the inheritability of genetic endowments has increased over time, which is unlikely), though further analysis is needed to reach a definitive conclusion.

Intensified competition for entrance to universities may have led to increased emphasis on earlier investments in children's human capital among parents, and this may, in turn, have increased the relative importance of adolescent academic ability for children's overall educational attainment. It should also be noted that eligibility for major student loans available for students seeking tertiary education in Japan depends on children's academic performance at school, as described in Section 4. This implies that unless children have acquired adequate academic ability by the time they go on to tertiary education, they are less likely to have the option of availing themselves of student loans to overcome financial difficulties for obtaining tertiary education. However, there is significant variation in the amount of money parents spend on children's pre-tertiary education in the case of Japan, as shown in Figure 2. Such variation may widen the disparity in children's ability at relatively early ages and thence the disparity in children's overall educational attainment. In other words, our regression results suggest that while borrowing constraints played some role in keeping the intergenerational persistence of educational attainment relatively high in older cohorts, adolescent academic ability seems to have become more important for intergenerational educational mobility in more recent years.

7. Conclusions

Using data on Japan from the Preference Parameters Study, this paper examined the intergenerational transmission of educational attainment for children born between 1946 and 1989. By exploiting unique information on whether children have ever given up schooling for financial reasons, and if they have, which level of schooling they have

forgone, it assessed the importance of borrowing constraints for intergenerational educational mobility.

The paper finds that the extent of the intergenerational transmission of educational attainment has remained high throughout the postwar period in Japan. While borrowing constraints had a significant impact on intergenerational educational mobility for older cohorts, they no longer seem to act as an obstacle for enhancing intergenerational educational mobility for the youngest cohort we examined in this paper. Instead, children's adolescent academic ability seems to have become more important today than in the past.

The important policy implication of the above findings is that the provision of student loans or scholarships for students facing financial difficulties may have only a limited effect on enhancing intergenerational educational mobility. On the other hand, our finding of an increase in the relative importance of adolescent academic ability for children's overall educational attainment over time suggests that earlier investments in children's human capital are becoming increasingly important for their educational advancement. This, in turn, constitutes a further argument for why merely providing student loans and/or scholarships for tertiary education may not be enough to tackle the perpetuation of educational inequality from generation to generation.

The empirical analysis conducted in this paper is, however, not without caveats. Due to the lack of data needed to implement appropriate identification strategies, we could not disentangle the effect of parents' educational attainment from the effect of their unobserved characteristics, such as genes, preferences, and/or family environment, on children's educational attainment. In this regard, recent policy changes such as the enactment of the Act on Free Tuition at Public High Schools and the High School Enrollment Support Fund in 2010, which made tuition fees for public high schools free and provided subsidies to students enrolled in private high schools (the program was later revised in 2014), may be exploited in the future using data on more recent cohorts. Related to this point, another important direction for future work is to examine the key determinants of adolescent academic ability. Furthermore, given the increasing number of single-mother households in recent decades in Japan, it is important to assess the implication of growing up in such households for children's educational attainment as well as for intergenerational educational mobility.

References

Bartholomew, D. J. (1973), *Stochastic Models for Social Processes*, 2nd edition, London: John Wiley and Sons Ltd.

Becker, G. S. and N. Tomes (1986), "Human Capital and the Rise and Fall of Families," *Journal of Labor Economics*, 4(3), pp. S1-S39.

Becker, G. S., S. D. Kominers, K. M. Murphy, and J. L. Spenkuch (2015), "A Theory of Intergenerational Mobility," Available at SSRN: https://ssrn.com/abstract=2652891.

Belley, P. and L. Lochner (2007), "The Changing Role of Family Income and Ability in Determining Educational Achievement," *Journal of Human Capital*, 1(1), pp. 37-89.

Black, S. E. and P. J. Devereux (2011), "Recent Developments in Intergenerational Mobility," in Card, D. and O. Ashenfelter (eds) *Handbook of Labor Economics*, Amsterdam and Oxford: Elsevier.

Blanden, J. (2013), "Cross-country Rankings in Intergenerational Mobility: A Comparison of Approaches from Economics and Sociology," *Journal of Economic Surveys*, 27(1), pp. 38-73.

Blanden, J., P. Gregg, and L. Macmillan (2007), "Accounting for Intergenerational Income Persistence: Noncognitive Skills, Ability and Education", *Economic Journal*, 117(519), pp. C43-C60.

Cameron, S. V. and J. J. Heckman (1998), "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males," *Journal of Political Economy*, 106(2), pp. 262-333.

Cameron, S. V. and J. J. Heckman (2001), "The Dynamic of Educational Attainment for Black, Hispanic, and White Males," *Journal of Political Economy*, 109(3), pp. 455-499.

Carneiro P. and J. J. Heckman (2002), "The Evidence on Credit Constraints in Post-Secondary Schooling," *Economic Journal*, 112(482), pp. 705-734.

Caucutt, E. and L. Lochner (2017), "Early and Late Human Capital Investments, Borrowing Constraints, and the Family," *HCEO Working Paper Series*, No. 2017-040, Chicago: Human Capital and Economic Opportunity Global Working Group (HCEO).

Checchi, D., C. V. Fiorio, and M. Leonardi (2013), "Intergenerational Persistence of Educational Attainment in Italy," *Economics Letters*, 118(1), pp. 229-232.

Chusseau, N., J. Hellier, and B. Ben-Halima (2013), "Education, Intergenerational Mobility and Inequality," in Hellier, J. and N. Chusseau (eds) *Growing Income Inequalities*, London: Palgrave MacMillam.

Corak, M. and A. Heisz (1999), "The Intergenerational Earnings and Income Mobility of Canadian Men: Evidence from Longitudinal Income Tax Data," *Journal of Human Resources*, 34(3), pp. 504-533.

Gaviria, A. (2002), "Intergenerational Mobility, Sibling Inequality and Borrowing Constraints," *Economics of Education Review*, 21(4), pp. 331-340.

Grawe, N. D. (2004), "Reconsidering the Use of Nonlinearities in Intergenerational Earnings Mobility as a Test for Credit Constraints," *Journal of Human Resources*, 39(3), pp. 813-827.

Grawe, N. D. and C. B. Mulligan (2002), "Economic Interpretations of Intergenerational Correlations," *Journal of Economic Perspectives*, 16(3), pp. 45-58.

Han, S. and C. B. Mulligan (2001), "Human Capital, Heterogeneity and Estimated Degrees of Intergenerational Mobility," *Economic Journal*, 111(470), pp. 207-243.

Heckman, J. J. and S. Mosso (2014), "The Economics of Human Development and Social Mobility," *Annual Review of Economics*, 6, pp. 689-733.

Hellier, J. (2017), "Education, Intergenerational Mobility and Social Stratification in Economic Theory: An Encompassing Approach," mimeo, University of Nantes.

Hertz, T., T. Jayasundera, P. Piraino, S. Selcuk, N. Smith, and A. Verashchagina (2007), "The Inheritance of Educational Inequality: International Comparisons and Fifty-Year Trends," *The B. E. Journal of Economic Analysis & Policy*, 7(2), Article 10.

Higuchi, Y. (1992), "Kyoiku wo Tsujita Sedaikan Shotokuiten" (Intergenerational Income Transfers through Education) (in Japanese), *Nihon Keizai Kenkyu* (JCER Economic Journal), Vol. 22, pp. 137-165.

Hojo, M. (2008), "Kyouikuwo Tsuujita Sedaikan Shotokuiten," (Intergenerational Income Transfers through Education) (in Japanese), in Horioka, C. Y. and the Institute for Research on Household Economics (eds) *Setainai Bunpai to Sedaikan Iten no Keizai Bunseki* (Economic Analysis of Intra-household Distribution and Intergenerational Transfers), Kyoto: Minerva Shobo.

Holmlund, H., M. Lindahl, and E. Plug (2011), "The Causal Effect of Parents' Schooling on Children's Schooling: A Comparison of Estimation Methods," *Journal of Economic Literature*, 49(3), pp. 615-651.

Karagiannaki, E. (2017), "The Effect of Parental Wealth on Children's Outcomes in Early Adulthood," *Journal of Economic Inequality*, 15(3), pp. 217-243.

Keane, M. P. and K. I. Wolpin (2001), "The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment," *International Economic Review*, 42(4), pp. 1051-1103.

Kubota, K. (2016), "Credit Constraints, Education, and Intergenerational Mobility:

Evidence from U.S. Survey Data," paper presented at Tokyo Labor Economics Workshop on May 13, 2016.

Lochner, L. and A. Monge-Naranjo (2012), "Credit Constraints in Education," *Annual Review of Economics*, 4, 225-256.

Mazumder, B. (2005), "Fortunate Sons: New Estimates of Intergenerational Mobility in the United States Using Social Security Earnings Data," *Review of Economics and Statistics*, 87(2), pp. 235-255.

Mulligan, C. B. (1997), *Parental Priorities and Economic Inequality*, Chicago: University of Chicago Press.

Niimi, Y. and C. Y. Horioka (2017), "The Impact of Intergenerational Transfers on Wealth Inequality in Japan and the United States," *World Economy*, forthcoming, DOI: 10.1111/twec.12544

Oshio, T. and W. Senoh (2005), "The Economics of Education in Japan: A Survey on Empirical Studies and Unresolved Issues" (in Japanese), *Keizai Bunseki* (Economic Analysis), 175, pp. 105-139.

Restuccia, D. and C. Urrutia (2004), "Intergenerational Persistence of Earnings: The Role of Early and College Education," *American Economic Review*, 94(5), pp. 1354-1378.

Roemer, J. E. (1998), *Equality of Opportunity*, Cambridge: Harvard University Press.

Shorrocks, A. F. (1978), "The Measurement of Mobility," *Econometrica*, 46(5), pp. 1013-1024.

Solon, G. (1992), "Intergenerational Income Mobility in the United States," *American Economic Review*, 82(3), pp. 393-408.

Zimmerman, D. J. (1992), "Regression Toward Mediocrity in Economic Stature," *American Economic Review*, 82(3), pp. 409-429.