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Babies on a Budget: How the Cost of Child-Rearing Affects Fertility in Japan

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Abstract: This paper examines the relationship between child-rearing costs and fertility in Japan. Using panel data from the Japanese Panel Survey of Consumers, we investigate the issue through two distinct approaches. Firstly, we construct a proxy for expected child-rearing costs and attempt to find a link to the propensity of having children. Secondly, we draw on methodology from Kleven et al. (2019) to study impacts of children on labour market outcomes for men and women.

Using our first approach, we find no significant effects of child-rearing costs on fertility, but results are limited, partly due to the low variation of our aggregated cost variable. Control variables for employment and earnings do yield significant results, showing that respondent employment raised fertility, while higher earnings lowered it.

Using our second approach, we find significant and substantial negative effects on labour market outcomes for women but not for men. The effect on earnings for women compared to men is estimated at 35 percent. We argue for a link between impacts on labour market outcomes and the propensity to have children and conclude that steps should be taken to increase the compatibility of employment and child-rearing.

Keywords: fertility, family planning, panel data, child-rearing costs, child penalty

JEL: D10, C23, J13

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1 Introduction

Japan is currently grappling with a severe demographic crisis, driven in part by the country having one of the lowest birth rates in the world. In January 2023, Prime Minister Fumio Kishida issued a warning in a speech to the National Diet, stating that the country 'is standing on the verge of whether we can continue to function as a society' and that dealing with the issue was a case of 'now or never' (CNN 2023).

The birthrate dilemma facing the Japanese government is not new – in 1989, the so-called '1.57 shock' occurred when the total fertility rate (TFR) fell to the historically low level of 1.57, far from the rate of around 2.1 needed to sustain a population, sparking concerns about the demographic future of the country (Yanagishita 1992; Craig 1994). Despite numerous initiatives since, the total fertility rate has fallen and remained low, estimated to be 1.3 in 2020 (The World Bank n.d.[f]). Since 2007, deaths have outnumbered births every year, and in 2022, the number of births fell short of 800,000 for the first time since records started in 1899 (Ministry of Health, Labour and Welfare of Japan n.d.; CNN 2023).

In tandem with its decrease in size, the population of Japan is also rapidly ageing, with 10 percent being aged 65 or older in 1985, a figure which rose to nearly 30 percent in 2020 (Statistics Bureau of Japan n.d.). The elderly rely on those of working age to support them, and this dependency ratio grows larger as the share of workers in the population gets smaller. The consequences of this are severe – labour shortages, increases in public expenditures and a fall of more than 25 percent in real GDP during the coming decades are only some of the adverse effects expected to impact the Japanese people (Suzuki 2005; Colacelli and Corugedo 2018). Since there is no desire to change the patterns of high life expectancies, finding ways to support fertility will prove essential for Japanese policymakers in the coming years to avoid the worst effects of the rapidly diminishing and ageing population.

Finding reasons to explain falling birth rates has proven difficult, mainly owing to the multifaceted nature of fertility and family decisions. However, when asked, Japanese women cite the costs of rearing children and the impact children have on their careers as some of the most significant obstacles to childbearing (National Institute of Population and Social Security Research 2016). This paper will explore the impact of these obstacles. We investigate expected costs of child-rearing and their impact on fertility as well as opportunity costs facing women in the labour market, quantified by so-called 'child penalties' in labour market outcomes.

The expected costs of child-rearing are those which a potential parent might anticipate paying in the future to support and raise their child, and in Japan, those costs are high, not least the ones associated with education. On average, the cost of three years of high

school, followed by four years of university has been estimated to be ¥9,425,000[1] (Japan Finance Corporation 2020). The average tuition fee for a private university rose from ¥182,677 in 1975 to ¥930,934 in 2021[2] (Ministry of Education, Culture, Sports, Science and Technology of Japan n.d.). Despite this, the number of graduates has increased (OECD 2022). This can be attributed to strong societal pressure and norms around education, which are not unfounded – enrolment at a prestigious university in Japan leads to clear, life-long economic benefits (Tan et al. 2016). A 2015 survey found that 75 percent of Japanese parents expect their male children to attend university (National Institute of Population and Social Security Research 2016).

Diprete et al. (2003) found a negative relationship between the cost of children and fertility, while Blau and Robins (1989) concluded that higher childcare costs negatively affect the fertility of unemployed women. Furthermore, Oyama (2006) used data from the Japanese Panel Survey of Consumers, just as in this paper, and found a negative relationship between child-rearing costs and the number of children born to married couples. Additionally, there is also empirical evidence that increased benefits have a positive relationship with fertility, as it alleviates the burden of costs incurred due to children (Gauthier and Hatzius 1997).

The opportunity costs of child-rearing are the losses a potential parent might incur when giving up on opportunities due to child-rearing, the most obvious of which is the income from their work. Because of the nature of being pregnant and having children, these opportunity costs are essentially always higher for women, who often stay home from work during parts of their pregnancy and after giving birth. In conservative Japan, where it is still common for women to become housewives after having children, this effect is especially pronounced.

Norms around the family and an incompatibility of working and child-rearing (e.g., due to lacking availability of childcare leave) might drive women to delay their return to full-time work or lead them to never start working again, which increases opportunity costs. In Japan, these two reasons currently conflict with each other. Norms *are* changing, with the share of Japanese women stating that they wish to balance work and family life rather than become housewives getting larger, but at the same time, access to childcare leave at work and childcare services such as kindergartens are still relatively poor and women also carry out an unproportionate amount of household chores (National Institute of Population and Social Security Research 2016; OECD 2017a; OECD 2017b). As such, the opportunity costs of having children remain substantial for Japanese women.

Kleven et al. (2019) analyse these so-called 'child penalties', i.e., effects of children on labour market outcomes, for Danish parents and conclude that effects are significantly negative and larger for women than compared to men when measuring earnings, labour

[1] $69,430 as of May 2023. ¥1,000 is equal to about $7.4.
[2] $1,346 to $6,858.

force participation, working hours and wage rates. Additionally, they found that women were, following the birth of their first child, more likely to occupy positions seen as more acquiescent for balancing professional and private life and less likely to occupy managerial positions. Blau and Robins (1989) also found that increased childcare costs had a negative relationship with the rate of entering employment while increasing the rate of leaving employment.

These issues draw on theories put forth by Becker on the quantity and quality of children, which explains changes in fertility in terms of relative price and income changes. Due to the budget constraint of a household, there is a trade-off between the quantity and quality of children. Both the quantity and quality of children provide parents with utility, but the latter is achieved through human capital investment. Thus, when one's relative income increases or costs fall, parents may choose to either invest further into their children's quality or to have more children. Becker argues that children could be compared to normal goods and that parents therefore are more likely to invest in their education as households generally purchase higher quality versions of goods when their relative income increases, rather than buying more of them (Doepke 2015). However, there is also a possible substitution effect. As the relative income increases or costs fall, the opportunity costs of a child increase. Therefore, parents may choose to have fewer children (Diprete et al. 2003).

Using average yearly child-rearing expenses in eight regions in Japan as a proxy for expected costs, we attempt to estimate its impact on fertility. Because of the low variation in our data, we do not find any significant results. However, we find clear links between women's earnings and women's employment on fertility decisions, where employment raises the propensity to have a child and higher earnings lower it.

Opportunity costs are investigated by performing the same analysis as in Kleven et al. (2019). We find several parallels between the results from our Japanese data and the results for Danish parents, namely, significant penalties for women in earnings, working hours and wage rates following the birth of a first child. Effects were in general larger for our subjects than in Kleven et al. Unlike for Danish women, participation rates seem to recover to pre-child levels for Japanese women, and we find that it is driven largely by increases in part-time employment, a form of working which does not seem to be able to bring earnings back to pre-child levels.

We aim to contribute to existing literature by further examining the link between child-rearing costs and fertility in Japan as well as investigating the opportunity costs that childbearing Japanese women face on the labour market.

The paper is laid out as follows: Section 2 covers background information on Japanese fertility and the factors that influence it; Section 3 outlines the theoretical framework around costs and children; Section 4 contains our hypotheses; Section 5 describes our data; Section 6 contains results for the analysis of expected costs; Section 7 contains

results for the analysis of opportunity costs; Section 8 discusses the results; and Section 9 contains conclusions, theoretical limitations and recommendations for future research.

2 Background

2.1 Japan's population decline

The total population of Japan has been in decline since 2010, peaking at 128.06 million and since then falling to 124.91 million by November 2022 (e-Stat: Portal Site of Official Statistics of Japan 2022; Statistics Bureau of Japan 2023a). Since 2007, the death toll has outnumbered the number of live births in Japan, with the gap steadily growing greater. In 2021, 811,622 live births were recorded, compared to 1,439,856 deaths (Ministry of Health, Labour and Welfare of Japan n.d.). As such, the population is shrinking at increasing speed.

This decline follows an era of strong population growth. The Japanese population began growing rapidly at the turn of the 20th century and the growth continued until the end of the century, ultimately tripling the population size. The end of World War Two brought with it a baby boom, sustained by advancements in food production. However, the strong growth did not last and during the subsequent decades the growth rate of the population fell. There was a smaller boom during the 1970s, as the generation born during the post-World War boom began bearing children, but since then the growth rate and total fertility rate have fallen (Suzuki 2005).

The total fertility rate (TFR) measures the number of expected total births per woman given current age-specific fertility rates. The replacement rate needed to keep a population stable in numbers can be argued to be a TFR of around 2.1 in most developed nations, depending on their mortality rates (Craig 1994). In Japan, the replacement rate needed has been approximately 2.1 since the 1970s (Suzuki 2005). However, the last time the actual TFR of Japan reached 2.1 was in 1973, and it has subsequently fallen and stabilised around 1.3 to 1.4 since 1995 (The World Bank n.d.[f]). Thus, while the fertility rate remains at a level similar to that in the 1990s, childbearing cohorts are decreasing in size due to the TFR being below 2.1, and therefore the Japanese population is shrinking and is projected to continue doing so (National Institute of Population and Social Security Research 2017).

The National Institute of Population and Social Security Research outlines three different scenarios: a low-, medium-, and high-fertility projection. All three start in 2015, when the population had declined to 127.09 million people, and assume medium mortality. In the scenario of low fertility, the population will fall to 110.92 million by 2040 and 88.08 million by 2065. Comparably, according to the medium-fertility projection the population will fall to 113.74 million by 2040 and 94.90 million by 2065. Lastly, the

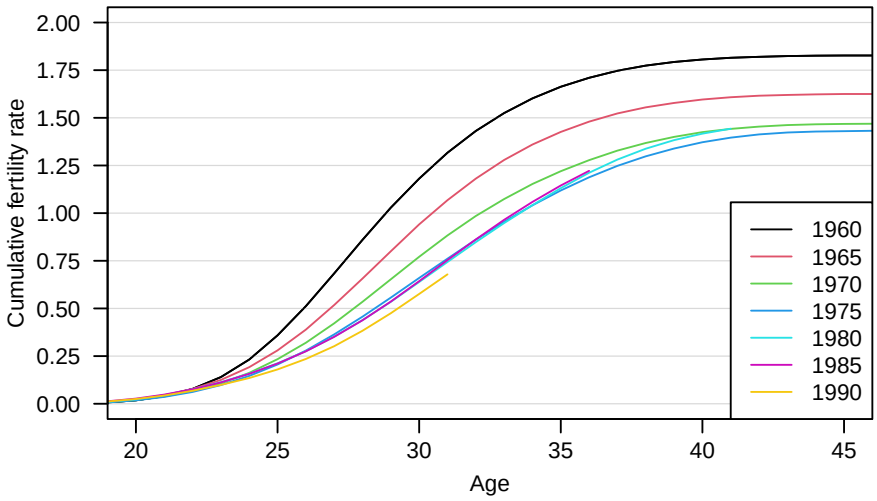

FIGURE 1: CUMULATIVE FERTILITY RATES, SELECTED COHORTS

Notes: Data from the Human Fertility Database (Max Planck Institute for Demographic Research and Vienna Institute of Demography 2023).

high-fertility scenario predicts a fall to 108.33 million by 2040 and 82.13 by 2065. Thus, even in high-fertility conditions, the population of Japan is projected to shrink rapidly (National Institute of Population and Social Security Research 2017).

2.2 Fertility statistics

Figure 1 below illustrates the average number of children women of different age cohorts have had at different ages. Thus, this measure eliminates childbearing age distortions in comparison to the TFR, as it measures the fertility of specific cohorts in relation to their childbearing age (Suzuki 2005). As seen in the figure, there have been changes in the quantum and tempo of fertility as Japanese women are generally having children later in life and having fewer in number. Differences between the cohorts are largest among the eldest, but there is still a decline when comparing the younger cohorts. Generally, the women seem to finish bearing children a few years after reaching the age of 40.

The changes in fertility patterns can also be seen in the responses to the National Fertility Survey. Couples that have been married for 15 to 19 years are considered to be finished with their childbearing and their average number of children is outlined in Table 1.

Throughout the years, the completed number of children to married couples has fallen from 4.27 in 1940 to 1.94 in 2015. While the decline stabilised after 1972, there has still been a downward trend since 2005 (National Institute of Population and Social Security Research 2016).

Figure 2 shows the share of women reaching first to fourth parity, i.e., having at least one to four children.

Table 1: Completed number of children born to married couples

Survey (Survey year)	Completed number of children
1st survey (1940)	4.27
2nd survey (1952)	3.50
3rd survey (1957)	3.60
4th survey (1962)	2.83
5th survey (1967)	2.65
6th survey (1972)	2.20
7th survey (1977)	2.19
8th survey (1982)	2.23
9th survey (1987)	2.19
10th survey (1992)	2.21
11th survey (1997)	2.21
12th survey (2002)	2.23
13th survey (2005)	2.09
14th survey (2010)	1.96
15th survey (2015)	1.94

Notes: Data from the The Fifteenth Japanese National Fertility Survey (National Institute of Population and Social Security Research 2016).

Table 2: Changes in number of children born to married couples

Survey (Year)	# of children (% of couples)					Completed number of children
	0	1	2	3	4+	
7th survey (1977)	3.0	11.0	57.0	23.8	5.1	2.19
8th survey (1982)	3.1	9.1	55.4	27.4	5.9	2.23
9th survey (1987)	2.7	9.6	57.8	25.9	3.9	2.19
10th survey (1992)	3.1	9.3	56.4	26.5	4.8	2.21
11th survey (1997)	3.7	9.8	53.6	27.9	5.0	2.21
12th survey (2002)	3.4	8.9	53.2	30.2	4.2	2.23
13th survey (2005)	5.6	11.7	56.0	22.4	4.3	2.09
14th survey (2010)	6.4	15.9	56.2	19.4	2.2	1.96
15th survey (2015)	6.2	18.6	54.0	17.9	3.3	1.94

Notes: Data from the The Fifteenth Japanese National Fertility Survey (National Institute of Population and Social Security Research 2016).

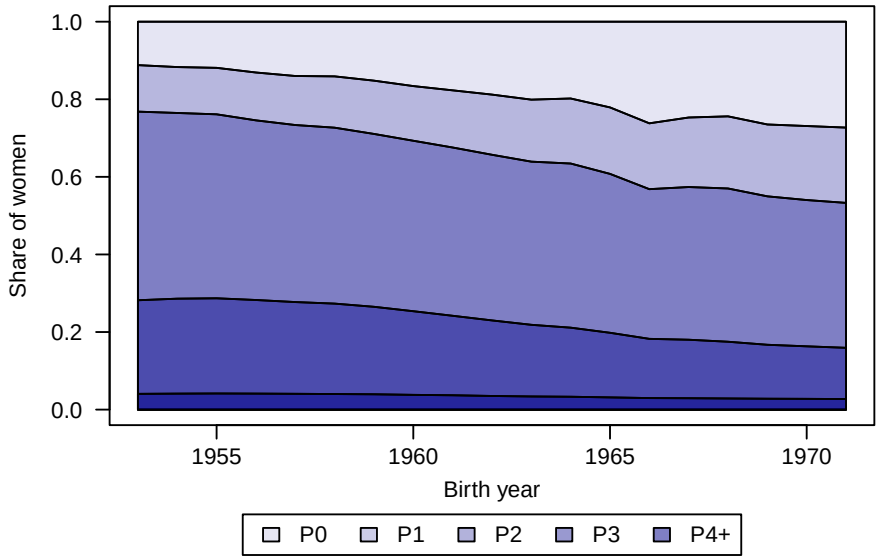

FIGURE 2: COMPLETED PARITIES

Notes: Data from the Human Fertility Database (Max Planck Institute for Demographic Research and Vienna Institute of Demography 2023).

The share of women having one or two children has gradually declined throughout the cohorts. There is also a smaller decline in the share of women having three children. This illustrates that fewer women choose to have children, and also that those who do have fewer in number.

This is further illustrated in Table 2, which contains data from the National Fertility Survey. While the share of married couples having one child has increased, the average completed number of children has fallen as the shares of couples having two, three or four children have fallen (2016).

2.3 An ageing population

The demographic shift led by the fall in fertility leads not only to a decrease in population size but an increase in the average age of the population, as well. As the baby boom cohorts of the post-World War era enter the latter part of their lives at the same time as fewer and fewer babies are born, the relative size of the elderly population increases. This shift is seen in all countries with low fertility but is especially pronounced in Japan where individuals are expected to live 84.7 years according to 2021 data, the highest among OECD countries (2021).

As the elderly constitute a larger share of the population, the share of those of working age decreases, leading to a higher so-called dependency ratio, as in, the ratio between those depending on the working age population and the working age population. In 2021, the dependency ratio was 1:2, meaning that every two people of working age supported one person outside working age (The World Bank n.d.[a]). This is expected to increase

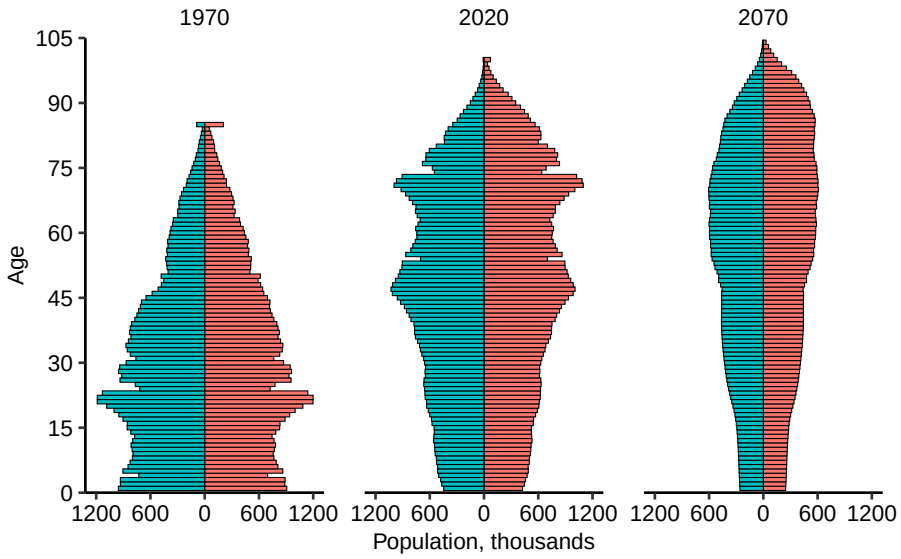

FIGURE 3: HISTORICAL AND PROJECTED AGE DISTRIBUTIONS

Notes: Historical data from the Statistics Bureau of Japan (2023b). Projected data from the National Institute of Population and Social Security Research (2023).

further, estimated to reach nearly 1:1 by 2060 (European Parliament 2020).

A smaller share of the population must then sustain a rapidly growing share of elderly, increasing in number as the population ages but also due to longer life expectancies. As such, the Japanese economy will be strongly affected, for example, through labour shortages, less tax revenue, and higher public expenditures (Suzuki 2005). The International Monetary Fund has estimated that in the coming decades the shifting age structure will have a negative impact on the economic growth of the nation with as much as a fall of 0.8 percent per year on average (2018).

In addition, the Japanese medical system is under increasing strain as the dependency burden is worsened (Suzuki 2005). For example, in 2018, 10.9 percent of GDP was allocated toward healthcare and this share is projected to increase to 12.1 percent in 2030 (European Parliament 2020). These numbers can be compared to the OECD average of 8.8 percent in 2019 (OECD 2021). The main driver of this cost increase is the elderly share of the population, as the healthcare expenditure per capita was ¥939,000 in 2018 for those aged 75 and older and ¥222,000 for those below that age bracket (European Parliament 2020).

When considering consumption and production of goods and services, it becomes clear that, on average, the elderly and children are both net consumers, while the population aged such that they are included in the labour force are net producers (Kendig et al. 2016). To make up for the deficits, intergenerational transfers occur between the groups, which are both public and private in nature. However, as a country develops economically, these transfers generally become more provided publicly rather than re-allocated privately

(Lee and Mason 2019). Amplified by budget constraints growing tighter with less taxable revenue, it has been suggested that a crowding-out effect may occur. As the elderly have more political power, due to their age and share of the population, as well as the increasing cost of sustained health care as the average age increases, resources might be allocated towards the elderly instead of the young, further hampering fertility (Kendig et al. 2016). While an ageing population alone would cause complex societal challenges, these potential issues are exacerbated by a TRF well below the replacement rate.

2.4 Causes of the fertility decline

Several causes of the Japanese fertility decline have been identified, illustrating its multifaceted nature. Those most relevant for the scope of this paper are outlined below.

In the Japanese National Fertility Survey, never-married women are asked for their desired number of children. The average number was 2.29 in 1982, and it decreased to 2.02 in 2015. It also decreased among married couples, from 2.61 in 1977 to 2.32 in 2015. The survey also asks for the *intended* number of children among married couples. For each survey mentioned in the report, it was lower than the desired number of children. For example, in the 8th survey, conducted in 1982, the ideal number of children was 2.62 on average but the intended number was 2.20 and in the 15th survey corresponding statistics were 2.32 and 2.01, respectively (National Institute of Population and Social Security Research 2016).

If couples in the survey responded with different numbers of intended and desired children, the survey asked them about this discrepancy. The single biggest reason why couples intended to have fewer children than actually desired was that 'it costs too much to raise and educate children'. This was stated by 76.5 percent of couples where the wife was below the age of 30 and 81.1 percent where she was between 30 and 34. Disregarding age and health reasons, the second biggest reason was also financial in nature: 'interference with one's job or business'. The financial impact of children seems to become greater as couples intend to have more children. Among couples whose desired number of children was three or more yet had an intended number of two or more, the direct cost was stated as a reason by 69.8 percent of couples, compared to 43.8 percent of couples who had a desired number of two or more yet only intended to have one child. Among couples who desired to have one or more children yet did not intend to have children, 15.6 percent of couples stated it as a reason. The same pattern can be found in the survey answer 'interference with one's job or business', which was stated by 16.1 percent, 11.8 percent, and 6.5 percent of couples, respectively (National Institute of Population and Social Security Research 2016).

Expenditures on child-rearing and their economic impact, both explicit and implicit, are named by Japanese couples as a significant reason why they do not have their ideal

number of children. We will therefore examine the impact of direct costs, as measured by costs potential parents can expect to pay, but also investigate potential opportunity costs of child-rearing caused by career interference, as measured by 'child penalties' in labour market outcomes due to children.

The decrease in fertility has also been attributed to the falling rates of marriage as well as older ages among those entering marriage. In 2018, only 2.3 percent of births were extramarital (European Parliament 2020). However, the mismatch in the marriage market is considered beyond the scope of this paper, which instead centres on fertility decisions within marriage. It should be noted that estimates of the effect of the decline in marriage rates on fertility vary, even more so when considering different time spans. However, 35 percent to 75 percent of the fall in TFR can be explained by falling marriage rates according to a range of estimates (Suzuki 2005).

2.5 Expected costs of children

One of the main drivers of the increase in the expected cost of child-rearing has been children's education. As Japan developed economically and technologically, so did the need for investment into human capital. This translated into higher costs for parents as the quality of children became more critical, which encouraged further investment in their education (Suzuki 2005). There are other kinds of human investment to consider as well, such as health care costs, which are implied in the very low child mortality rates of Japan (The World Bank n.d.[d]). However, large unexpected medical costs can also be argued to not be taken into account by potential parents as it can be assumed that few parents assume that their child will be born sickly or suffer from ailments needing serious medical intervention. Childbirth costs up to ¥1,000,000, most of which is subsidised by the government (Japan Healthcare Info n.d.).

As stated by women in the National Fertility Survey, one of the largest costs facing expectant parents with high educational expectations for their children is the cost of that education. The average cost for different educational stages can be seen in Figure 4, with data gathered from the Children's Study Expenses Survey (2021). The fee associated with public education increases with later stages of education for the child. Private options are expensive – for example, private high school costs around ¥1,000,000 per year on average. The enrolment rate in non-public schools is relatively high among upper secondary students, with around 30 percent choosing private options. However, it is highest among kindergarteners, which implies a shortage of public alternatives.

There are not only tuition fees to consider, but Japanese parents must also anticipate several other costs associated with the schooling of their children. In the 2021 Children's Study Expense Survey, several different types of parental expenditures associated with educational attainment are recorded. In addition to tuition and admission fees, there are

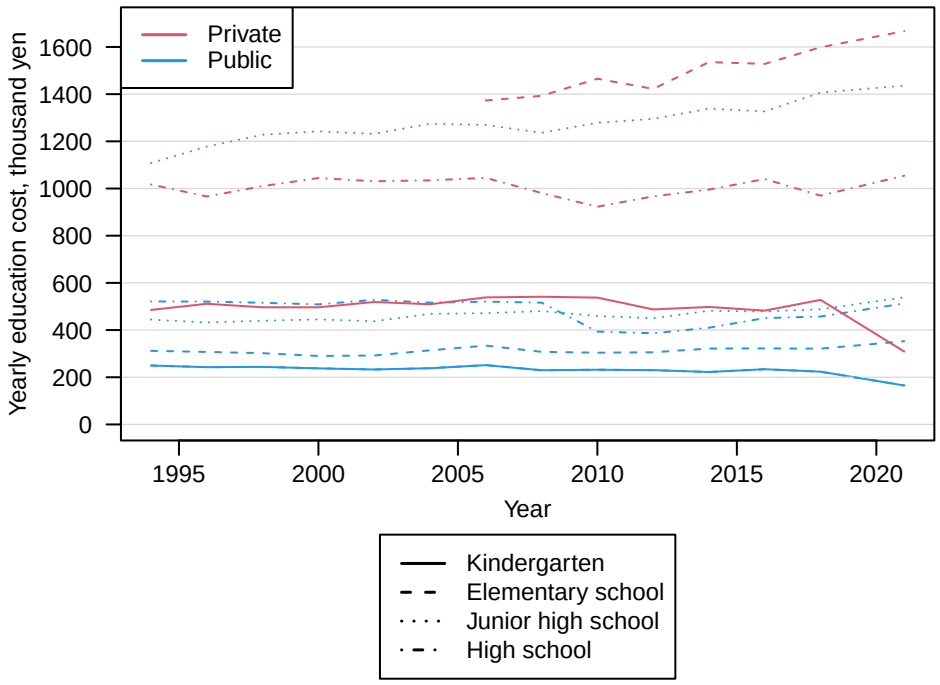

FIGURE 4: YEARLY COST OF EDUCATION BY EDUCATIONAL STAGE

Notes: Data from the Children's Study Expenses Survey (Ministry of Education, Culture, Sports, Science and Technology of Japan 2021).

also fees for facility maintenance, textbooks, PTA memberships, uniforms, and lunches.

Furthermore, in 2011, it was estimated that almost all high-school students that aim to attend university take part in cram schools, which are also attended by younger students, albeit to a lesser degree (The Economist 2011). Cram schools are attended after class and are a form of private instruction and tutoring, aimed at increasing the educational performance of the attending children (Allen 2016). According to the Children's Study Expense Survey, parents spent an average of ¥120,397 a year on cram school fees if their child attended a public high-school and ¥171,147 if they attended a private one (2021).

University tuition has increased as well. In 1975, the average tuition fee for a private university was ¥182,677, and for a public university it was ¥27,847. By 2005, those numbers had grown by 355 and 1,805 percent, respectively, to ¥830,583 and ¥530,586. Since then, the fees have stabilised but remain high. All in all, enrolling a child in three years of high school and four years of university in Japan costs on average ¥9,425,000 according to the Survey on the Burden of Educational Expenses conducted by Japan Finance Corporation in 2021 (2020). Despite this, the number of graduates has risen. In 2000 the share of 25 to 34-year-olds who had attained post-secondary education reached 48 percent, rising to 65 percent by 2021, higher than the OECD average (2022).

Clearly, educational costs are relatively high and therefore, so is the investment needed to maintain the relative competitiveness of one's child. This has been labelled as one of the main reasons for the fertility drop in Japan (Suzuki 2005). The high expenditure

on education invested by parents has been attributed to a number of different reasons, including societal pressure and importance placed on education as well as a strong correlation between economic returns and the perceived prestigiousness of the university the child later attends (Tan et al. 2016). The high expectations of educational attainment among parents can be seen in the National Fertility Survey of 2015, where 76.4 percent of couples expected a male child of theirs to attend university or higher, compared to 59.2 percent if the child was female (National Institute of Population and Social Security Research 2016).

Another cost to consider when starting and expanding a family is housing. Housing prices rose rapidly in Japan during the early 1960s, peaking in 1991. Using the year 2010 as a baseline with a value of 100, the residential housing prices rose from a value of 6 in 1960 to 182.55 in 1991. The prices then fell to 97.71 in 2009, slowly increasing after 2012 to the current level of 132.32 in 2022 (Economic Resarch, Federal Reserve Bank of St. Louis 2022).

2.6 Opportunity costs of children

Having children is associated with an opportunity cost due to the fact that parents – principally mothers – take time off work or leave work entirely to raise the child. Some researchers have found a link between this and fertility, observing that increased female labour force participation had a negative impact on fertility in Japan (Cheng et al. 1997).

Female labour force participation rate is rising in Japan but there is still a large gender employment and wage gap, among the largest of the OECD countries in 2017. Additionally, the OECD has stated in reports that the female labour participation rate is hampered by poor access to childcare services, illustrating the existence of a link between work and fertility. In 2017, Japan spent an equivalent of 0.5 percent of its GDP on early childcare services, which can be compared to many developed countries spending more than twice that amount (OECD 2017a). Moreover, the East-West Center estimated in 2005 that the opportunity cost associated with having and rearing a child for women in Japan is increasing as a higher proportion of women work and salaries rise (Retherford and Ogawa 2005).

Developments in female labour force participation can be seen in the aforementioned National Fertility Survey, where never-married women are asked about their ideal life course. In 1987, around 20 percent stated that it was to 'manage both work and family' while 30 percent wanted to be 'a full-time housewife'. In 2015, those who wanted to manage work and family had risen to 32 percent while those wanting to be housewives had fallen to 18 percent. This shift of values is reflected in the actual employment rates reported in the survey, which show that married women who intend to have children increasingly participate in the labour force (2016).

The increasing participation of women in the labour force has led to greater utilisation of childcare services. For example, in the National Fertility Survey, only 18.9 percent of parents used day-care centres for children under the age of three born between 1990 and 1994, while this increased to 37.4 percent for children born between 2010 and 2012. Additionally, the survey also notes that the average number of intended children is lower if external childcare services are not provided (National Institute of Population and Social Security Research 2016).

It is interesting to note that there are cultural differences in the dynamics between work and fertility when comparing different countries. For instance, Sweden and France are experiencing higher rates of female labour participation and higher fertility compared to Japan and South Korea where there is a negative relationship between the two. This has been attributed to cultural conflicts between housework and female labour force participation in Japan, where gender roles place a higher burden of household chores and child-rearing on women, making it more difficult for them to stay in work and focus on their careers when raising children (Suzuki 2005). In 2017, it was estimated that women perform more than 75 percent of household work and child-rearing (OECD 2017b). Hertog and Kan (2017) found that in China, Japan, South Korea, and Taiwan, there is a clear, positive correlation between male participation in housework and his wife's willingness to have more children, concluding that the skewed burden of housework may contribute to low fertility in these countries. In addition, Kato et al. (2018) found that husbands' participation in childcare had a positive effect on the number of children born to Japanese couples.

The incompatibility of work and child-rearing is exacerbated by Japanese corporate culture, where overtime and long hours are the rule rather than the exception, especially for men. Non-regular workers in Japan are predominantly female, while regular, full-time workers are predominantly men, arguably because of children and child-rearing (OECD 2017a).

It should be noted that paternity leave exists in Japan, but very few men make use of it. Less than 1 percent of men reported using it between the years 2000 to 2012 (National Institute of Population and Social Security Research 2016). It has been slowly rising, almost reaching 3 percent in 2017, but those who took leave often used much less than they were entitled to (OECD 2017b).

2.7 The Japanese economy

The aforementioned issues are compounded by the state of the Japanese economy. The 1990s has been termed the 'lost decade' as the strong growth and development of the Japanese economy came to an end with an economic crash, still felt today (Yoshino and Taghizadeh-Hesary 2015).

The Japanese economy has been experiencing sluggish or negative growth since the 1990s, especially in comparison to the time prior to the stagnation. This also caused higher levels of unemployment, which rose from 2.1 percent in 1991 to 5.4 percent in 2002, and only declined to previous levels during the late 2010s (The World Bank n.d.[g]). Additionally, Kambayashi and Kato (2017) found that the lost decade primarily affected the job security of those in the early to mid-stages of their career, emphasising the importance of seniority in times of economic turbulence. It can be assumed that couples in Japan in the midst of making fertility decisions are of ages without much seniority, and therefore more affected by decreasing job security. This insecurity can be seen in the job prospects of recent graduates. In 1988, nearly 78 percent of graduates were able to get a stable job, compared to 56 percent in 2004. Additionally, those who were unable to find employment or only worked part-time rose from 9 percent in 1988 to 24 percent in 2004. It has also been shown that part-time jobs reduced the likelihood of marriage among both men and women and earning less compared to that of one's father reduced it among men. As extramarital births are very rare in Japan, the economic impact on marriage rates is important to consider (Suzuki 2005).

The stagnation of the economy can be seen in the development of real wages in Japan. The real wage grew on average 1.16 percent between the years 1980 to 1990. However, between 1991 and 2012, the real wage declined instead at an average of 0.28 percent per year. Afterwards, it began to rise, with an average growth of 0.55 percent per year, but it has not reached the same level of growth as before the 1990s (Takenaka 2019).

Economic recessions have been shown to affect fertility decisions among couples in the population as they and their children might face a poorer economic outlook. Potentially childbearing couples may risk unemployment, lower real income, and other economic uncertainty (Sobotka et al. 2011). As such, they may choose to wait until the situation stabilises to have children or to have fewer children overall as they cannot afford the costs associated with rearing a child.

2.8 Japanese government policies

In 1989, Japan experienced the '1.57 shock' as the TFR fell to the historically low level of 1.57, causing public alarm (Yanagishita 1992). As a response, the so-called Angel Plan was launched in 1994, aimed at boosting fertility. The purpose of this initiative was to ease the burden of child-rearing through increasing the availability of childcare and parental leave as well as direct financial contributions. In 2009, the Angel Plan was amended to include the aim of assisting and encouraging women to not leave their careers once they have children (European Parliament 2020).

The failure of the Angel Plan to increase fertility means that urgency among Japanese leadership remains, with the current Prime Minister Fumio Kishida stating in 2023 that

Japan is 'on the brink of not being able to maintain social functions', stressing the coming years as crucial to reverse the trend and focusing on 'child-rearing support as our most important policy' (CNN 2023). In 2019 and 2020, various new policies were announced, including completely subsidising kindergarten, further promoting paternity leave, and increasing monetary contributions (European Parliament 2020). Moreover, Japan currently subsidises higher education for low-income families and has recently decided to raise the income cap, covering 200,000 more students. It is interesting to note that the policy mainly favours families with three or more children, as families with fewer children are only eligible for the additional aid if their children study certain subjects (The Japan Times 2023).

3 Theoretical framework

This paper draws on Becker's theory on the quantity and quality of children. Becker compared children to economic goods and assumed that the preferences in the society are given. Thus, he attempted to explain fertility as a variable affected by relative price and income changes. Becker also examines the trade-off between the quantity and quality of children in light of this. Both the quantity and quality of children provide parents with utility, but as the latter is achieved through human capital investment, there is a trade-off between the two. Through increased investment into elements such as different types of education or training, the quality of the child increases. Becker also proposed that the income elasticity is low for the quantity of children and high for the quality of children. Thus, when the income of the parents increases, they may not choose to have more children but rather invest more resources into them. Becker based this argument on the fact that he assumed children to be goods and that households generally do not purchase more goods when their income increases, but rather higher quality versions (Doepke 2015). However, one could also talk of a substitution effect. As mentioned previously, the opportunity cost of children has risen with rising female labour participation and higher earnings, meaning that women may choose to have fewer children. As such, the model could have different results. If one's income increases, one could be more hesitant to have a child as the opportunity cost has increased. Simultaneously, there is also more income to devote to either having more children or investing further in them, as per the income effect.

As noted above, the cost of children is mentioned as one of the main reasons Japanese women are having fewer children. Additionally, real wages have not increased much the inte the past years and the economic outlook has been poor. Thus, in order to keep the quality of children, as well as maintaining the relative quality compared to other children, parents may choose to have fewer in quantity, as in accordance with the theory set forth by Becker. However, it could also be a case of substitution, as women are taking a larger

place within the workforce, facing higher opportunity costs, and receiving little support to remain in it if they choose to have a child due to a lack of childcare support both inside and outside of the home.

3.1 Previous literature

Becker's theory has conflicting empirical support in the literature. Studies conducted at both the micro-level and the macro-level have contradictory results, where some are in support and some are not. For example, Angrist et al. (2010) found no evidence of a trade-off between the quantity and quality in Israeli data, while both Rosenzweig and Wolpin (1980) and Rosenzweig and Zhang (2009) found evidence of it in India and China, respectively.

Regarding the impact of direct costs of child-rearing on fertility, there have been a number of studies showing support for a negative relationship. In 1989, Blau and Robins (1989) used data from the United States to examine the relationship between childcare costs and fertility through an event-history analysis, taking place during 22 months. They found that higher childcare costs negatively affect the fertility of unemployed women and lower employment levels. They estimated that if weekly childcare costs increase by one dollar on average, the rate of leaving employment increases by 2 percent and the rate of entering employment decreases by 3 percent. Diprete et al. (2003) used fertility data from the United States, Denmark, Italy, former West Germany and the United Kingdom to see if differences in the cost of children internationally had contributed to different rates of fertility. They emphasise the difficulty in establishing causality due to differing measurements of child costs and other issues of comparing few, relatively similarly developed nations. However, they did find empirical support for a negative relationship between the cost of children and fertility rates. Moreover, they argued that differences in non-monetary costs and difficulties in balancing work and families for women contribute to country-specific fertility rates. Anderson and Kohler (2013) investigated the impact of high educational costs on fertility in South Korea, which also has high levels of educational expenditure. They claim that in certain East Asian nations, the quality of children is more important than quantity compared to other nations, which discourages parents from having more children in order to focus and increase educational investment in existing children.

Additionally, there is certain support within research that public benefits and allowances have a positive effect on fertility. Gauthier and Hatzius (1997) used data from 22 industrialised nations between 1970 to 1990 and found that an increase of 25 percent in benefits led to 0.07 more children being born per woman on average. Other studies have also found that such benefits may have a positive relationship with fertility rates. While these studies do not strictly measure the impact of child-rearing expenses as the

allowances may be used for other causes, it could be seen as an initiative alleviating the burden of childcare costs of parents and therefore increasing fertility rates.

Several researchers in Japan have estimated the impact of the cost of child-rearing on fertility. The following two articles were written in Japanese, but have been referenced in other works with clear descriptions of their methodologies and results. As they are deemed to be of high relevance to our paper, we have chosen to include them. Similarly to this paper, Oyama (2006) used panel data from the Japanese Panel Survey on Consumers to estimate the effects of child-rearing costs in Japan and on fertility. Through using an instrumental variable approach, she found a negative and statistically significant effect of child-rearing costs on the number of children born to married couples in the data set.

Oyama examined the cost of child-rearing through the Rothbart equivalence scale model, which examines the cost of an additional child in the household in relation to that of an adult in the household. She found that the cost of an additional child is 13 percent compared to that of an adult in the household, as the equivalence scale value was estimated to be 0.13. Children aged 6 or younger had a value of 0.12, while it was 0.26 for those aged between 14 and 18. Traditionally when applying Rothbarth's model, expenditure on adult goods is used, but Oyama instead used 'monthly expenditure for husband' and the equivalent for the wife. However, Oyama produced a later study in 2006, utilising a more subjective model developed by Charlier on the data from the Japanese Panel Survey on Consumers. By taking satisfaction with one's current income into account, her new study led to results even greater in magnitude. An additional child aged between 0 to 6 was estimated to cost 0.28 between 0.454 compared to an existing adult in the household, decreasing to a value between 0.277 and 0.407 if aged between 7 to 13, and rising to 1.090 to 3.329 if the additional child is aged between 14 to 18. The higher costs of the older children could be attributed to the cost of education according to Oyama. She further states that the aim of further research should be the influence of the high costs of child-rearing in Japan on fertility as well as 'the measurement of the opportunity cost of children' faced by expectant mothers on the labour market.

As noted by Becker, not only are direct costs taken into account when making fertility decisions, but also opportunity costs. The existence of child penalties, defined as adverse consequences women face in labour markets after having and rearing children, is clearly supported in research. When discussing the child penalty faced by Japanese women, this paper draws on Kleven et al. (2019), which examined child penalties in Denmark. They used a quasi-experimental approach and focused on the birth of a parent's first child to examine how it affected men and women in the labour market. The study found that men and women followed fairly similar patterns prior to the birth of a child, but that there was a strong difference in impact on outcomes post-birth which remained in place several years later. When quantifying the child penalty as 'the percentage by which women fall behind men due to children' in terms of earnings, the authors estimated it to

be around 20 percent, and even higher for women with more children. Additionally, they find similar effects on women in labour force participation, wage rate, and hours worked. Furthermore, after childbirth, women were also more likely to occupy positions seen as more acquiescent for balancing professional and private life, such as within the public sector, and were less likely to occupy managerial positions. The authors also find that while total gender inequality in earnings has decreased, the share caused by the child penalty had increased from 40 percent to 80 percent between 1980 and 2013.

We use similar data to that of Oyama, but include cohorts after the early 2000s and therefore have access to 27 years of data instead of 10. We also utilise a different approach by using the estimated costs of children as measured by parents in the survey instead of using equivalence scale models. We contribute by filling in some of the gaps in the literature, as outlined by Oyama, by examining the relationship between the direct costs of children and fertility as well as investigating opportunity costs faced by Japanese women upon having children. For the latter, we will be following the approach of Kleven et al. but in a different country and therefore a different cultural context. As stated earlier, Japan has one of the most unfavourable labour markets for women among OECD countries, and while attitudes regarding female workforce participation are shifting, they can be presumed to be generally more conservative compared to those facing Danish women. As such, we hope to provide deeper insights into how such a labour market affects Japanese mothers.

4 Research design

In light of our discussion and the scope of the paper, we define two hypotheses as follows:

> *High costs of child-rearing have a negative impact on Japanese families' propensity to have children.* (H1)

> *The opportunity costs of having children are higher for Japanese women relative to Japanese men.* (H2)

Fertility is a complex subject matter and many other factors have a significant effect – some of which we discuss in the following sections – but we limit our discussion and therefore also our analysis to that of the cost of child-rearing,

5 Data

5.1 The Japanese Panel Survey of Consumers

The primary data set used in the analyses of this paper is panel data from the Japanese Panel Survey of Consumers, or the JPSC for short (Panel Data Research Center at Keio

University 2022). Started in 1993 by the Institute for Research on Household Economics, it has been conducted annually since then and is one of the longest-running nationwide surveys in Japan. Since 2018, the Panel Data Research Center at Keio University has managed the survey (Sakaguchi 2013).

The purpose of the survey is to collect various data on Japanese households, including employment, savings, income and expenditures, family composition, lifestyle, and important events such as births, deaths, moves, marriage, divorce, and educational enrolment.

The JPSC respondents are all women, despite the neutral sounding 'Consumers' in its name. This was a deliberate choice, made partly due to the greater control and understanding of household finances that Japanese women are said to have in comparison to men, and more importantly, to allow for a closer examination of the life choices that specifically women make. The lives of women in Japan – a country whose level of equality long has been lagging behind other developed countries – have changed drastically in the last decades in terms of employment opportunities and available lifestyle choices, and these changes are believed to have significant effects on the channels which fuel Japan's current severe demographic challenges, not least fertility rates. The JPSC captures these changes and how they affect women.

5.2 Survey design and data characteristics

When the JPSC began in 1993, a nationally representative sample of 1,500 women aged 24 to 34 was drawn. Subsequently, new cohorts of women were added to the sample approximately every five years to compensate for attrition and to incorporate younger generations into the study. The age of the respondents in Cohort A spanned an 11-year range, while subsequent cohort ages spanned 4–6 years in order to add respondents of every birth year after the latest in Cohort A. The last and fifth group, Cohort E, was added in 2013. Each cohort contains approximately 125 subjects per age which now spans women born in the 1960s, added in the first cohort, to women born in the 1990s, added in the last cohort.

To select respondents, two-stage stratified sampling was used consistently across cohorts. The first stage strata are the eight regional blocks of Japan, and the second stage strata are the city classifications of that region (designated cities, cities, towns or villages). Each sampled cohort contains, in addition to the initially chosen subjects, three to seven similar backup subjects which were used to obtain the desired number of respondents in case initial subjects declined to participate.

The survey is a self-administered, paper-and-pencil style questionnaire. There are two different types of questionnaires that respondents receive based on whether they are married at the time of the survey or not. They broadly contain the same set of questions, where the only notable difference is that married respondents fill out information about

their spouse in addition to answering questions about themselves. Since the survey is filled out during the month of October each year, questions on monthly behaviour concern the preceding month of September, and questions on yearly behaviour concern the period between October of the preceding year and September of the current year. Spouses are only surveyed via their marriage to the respondent, which means that observed spouses always are married, and may change or drop out of the sample due to changes in civil status.[3]

We have been granted access to yearly JPSC data from the first survey wave in 1993 until the 28th wave in 2020. Data from the JPSC are not available until two years after the survey date to allow for collection, treatment and configuration of the collected survey data, which makes the 2020 data the latest available. Our data set contains a total of 52,144 person-year observations over 28 survey rounds, where a total of 4,120 unique women have been surveyed at least once, of which 1,898 remain in the latest round collected in 2020. A summary of cohort composition and characteristics can be found in Table 3.

5.3 Variable descriptions

Most variables in our data set are simple characteristics of the woman or household in question and require no further explanation. However, some of our variables of interest are constructed by us from the provided data or are in other ways more complicated, and are therefore explained below.

Cohort. Denotes the cohort to which a woman belongs. Takes the value A, B, C, D, or E – see the data description above for more information.

Panel. Denotes to which panel survey round an answer belongs. Takes a value between 1 and 28, where 1 corresponds to 1993, the first year in the data set, and 28 to 2020, the last year available.

Expected cost of child-rearing. A key part of our research question and reason for the writing of this paper is the impact of the cost of raising children on families' propensity to have a child. This is hard to measure, but we assume that potential parents form an expectation of what costs they might be facing after childbirth based on the current average costs of raising children in their area. To create a measure for this expectation, we take the average monthly per-child living expenses for each region and each year, as reported by married respondents of the survey.

Region. Japan has several regional administrative classifications, most notably its 47 prefectures. However, only a less granular geospatial variable was available, assigning respondents to one of eight regional blocks.

[3]To our knowledge, the sample contains only female respondents and male spouses, meaning that any results will have implications only in a heteronormative setting. The lack of recognition of any same-sex unions in Japan is likely the reason why only heterosexual couples are present in the sample.

Table 3: Response statistics per survey cohort

		All cohorts	Cohort A		Cohort B		Cohort C		Cohort D		Cohort E	
Panel	Year	Number of respondents	Number of respondents	Response rate (%)	Number of respondents	Response rate (%)	Number of respondents	Response rate (%)	Number of respondents	Response rate (%)	Number of respondents	Response rate (%)
1	1993	1500	1500	–	–	–	–	–	–	–	–	–
2	1994	1422	1422	94.80	–	–	–	–	–	–	–	–
3	1995	1342	1342	94.37	–	–	–	–	–	–	–	–
4	1996	1298	1298	96.72	–	–	–	–	–	–	–	–
5	1997	1755	1255	96.69	500	–	–	–	–	–	–	–
6	1998	1638	1196	95.30	442	88.40	–	–	–	–	–	–
7	1999	1549	1137	95.07	412	93.21	–	–	–	–	–	–
8	2000	1488	1102	96.92	386	93.69	–	–	–	–	–	–
9	2001	1425	1059	96.10	366	94.82	–	–	–	–	–	–
10	2002	1376	1032	97.45	344	93.99	–	–	–	–	–	–
11	2003	2139	980	94.96	323	93.90	836	–	–	–	–	–
12	2004	1980	944	96.33	312	96.59	724	86.60	–	–	–	–
13	2005	1870	904	95.76	292	93.59	674	93.09	–	–	–	–
14	2006	1774	875	96.79	278	95.21	621	92.14	–	–	–	–
15	2007	1706	847	96.80	271	97.48	588	94.69	–	–	–	–
16	2008	2284	828	97.76	260	95.94	560	95.24	636	–	–	–
17	2009	2168	799	96.50	255	98.08	541	96.61	573	90.09	–	–
18	2010	2089	778	97.37	246	96.47	522	96.49	543	94.76	–	–
19	2011	2024	765	98.33	243	98.78	507	97.13	509	93.74	–	–
20	2012	1966	750	98.04	234	96.30	496	97.83	486	95.48	–	–
21	2013	2550	735	98.00	231	98.72	480	96.77	456	93.83	648	–
22	2014	2391	704	95.78	222	96.10	462	96.25	436	95.61	567	87.50
23	2015	2267	676	96.02	216	97.30	447	96.75	418	95.87	510	89.95
24	2016	2168	654	96.75	204	94.44	431	96.42	401	95.93	478	93.73
25	2017	2099	638	97.55	200	98.04	422	97.91	383	95.51	456	95.40
26	2018	2023	614	96.24	194	97.00	412	97.63	373	97.39	430	94.30
27	2019	1955	597	97.23	188	96.91	403	97.82	359	96.25	408	94.88
28	2020	1898	583	97.65	178	94.68	393	97.52	343	95.54	401	98.28

Notes. Data from the JPSC (Panel Data Research Center at Keio University 2022) and summary from Sakaguchi (2013).

Parity. The parity of a woman is the number of live children she has given birth to so far. We construct a birth order variable based on reported family composition, which is a set of variables describing all family members living in the household, including any children who have moved away for studies, marriage or any other reason.

Birth in subsequent year. This variable takes the value 1 if one or more children is born in the subsequent year to a respondent, and 0 otherwise. In the rare case of twins/triplets/etc. or if two children are born less than 12 months apart during the subsequent year, this variable will still take the value 1, since *a* child was born. This is our outcome variable in all regressions in Section 6.

See Appendix A for a more detailed description of how the variables used in our analyses were constructed.

5.4 Summary statistics

The data set contains a large number of variables. Summary statistics for some of these are presented below.

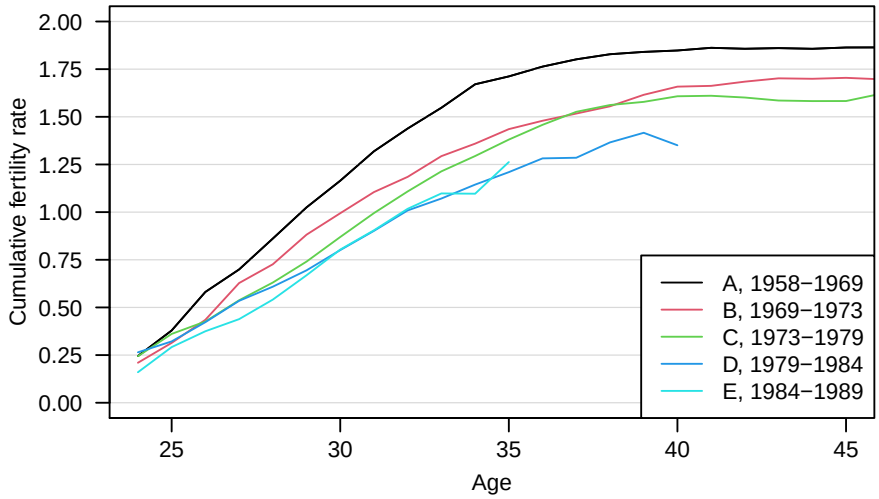

FIGURE 5: CUMULATIVE COHORT FERTILITY RATES, SURVEY RESPONDENTS

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

Cumulative fertility is defined as the total amount of live births to a woman so far in her life at a given time. Figure 5 shows the cumulative fertility rate per survey cohort. As seen in the graph, each consecutive cohort has had shifts both in the quantum and tempo of fertility, giving birth later and having fewer children overall.

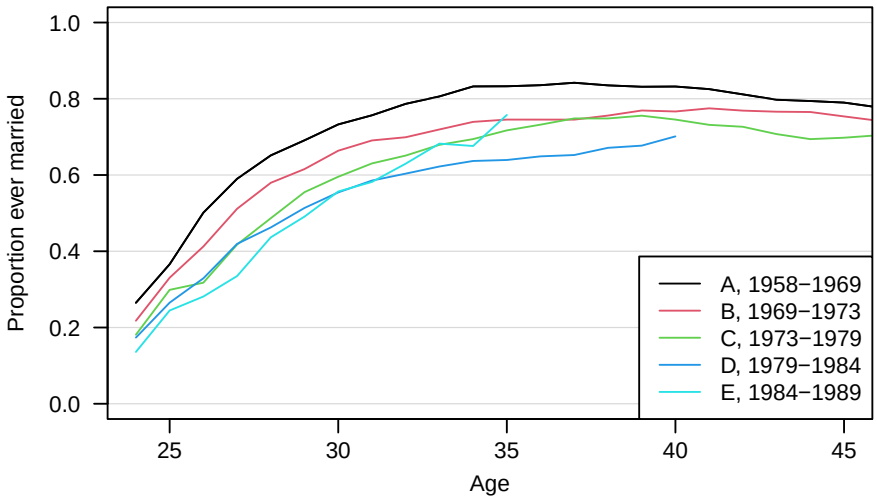

FIGURE 6: PROPORTION EVER MARRIED BY COHORT

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

Figure 6 shows the proportion of women in the sample who have ever been married. As with cumulative fertility rates, each subsequent cohort shows a tendency to shift downward and rightward, indicating that a lower share of women are getting married, and those who do enter wedlock at later stages in life. The downward slope in some curves, especially the one representing cohort A, is due to attrition.

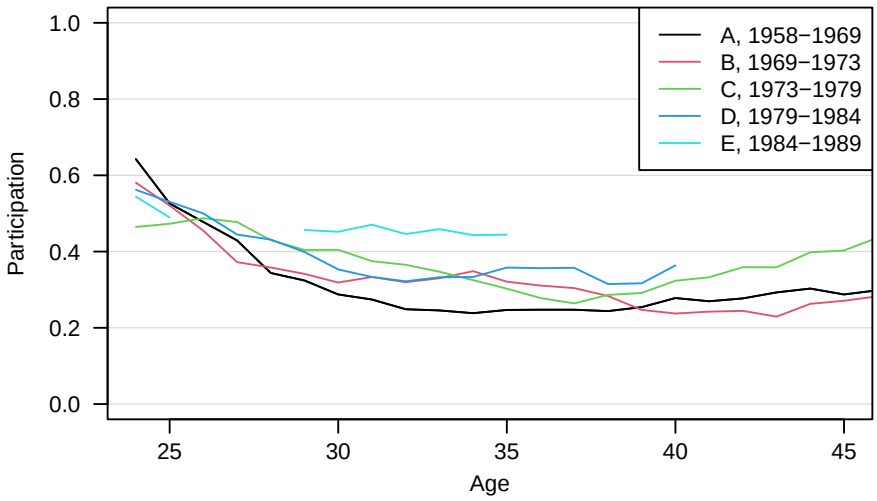

FIGURE 7: LABOUR FORCE PARTIPATION BY SURVEY COHORT

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

In line with our earlier discussion on lifestyle changes for women, Figure 7 shows increasing labour force participation among women in later survey cohorts. This is an oft-cited reason for lower fertility not only in Japan, but in many developed countries. Employment among women is an obstacle for fertility not only because of the incompatibility of child-rearing with work due to a lack of childcare services, but also because of

the traditional role in a marriage that many still expect Japanese women to conform to – staying at home and taking care of the children and the home.

Table 4: Child-rearing costs by age group

Age	Mean	Max	Min	St. dev.
24-28	12,19	480,00	0,00	24,68
29-33	13,67	500,00	0,00	25,94
34-38	15,81	600,00	0,00	32,05
39-43	21,07	875,00	0,00	54,27
44-48	28,55	965,00	0,00	112,55
>48	19,23	990,00	0,00	113,17

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

Table 5: Child-rearing costs by survey cohort

Cohort	Mean	Max	Min	St. dev.
A	19,62	990,00	0,00	76,08
B	17,60	950,00	0,00	54,22
C	17,20	830,00	0,00	44,61
D	14,77	480,00	0,00	30,38
E	14,13	167,00	0,00	24,63

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

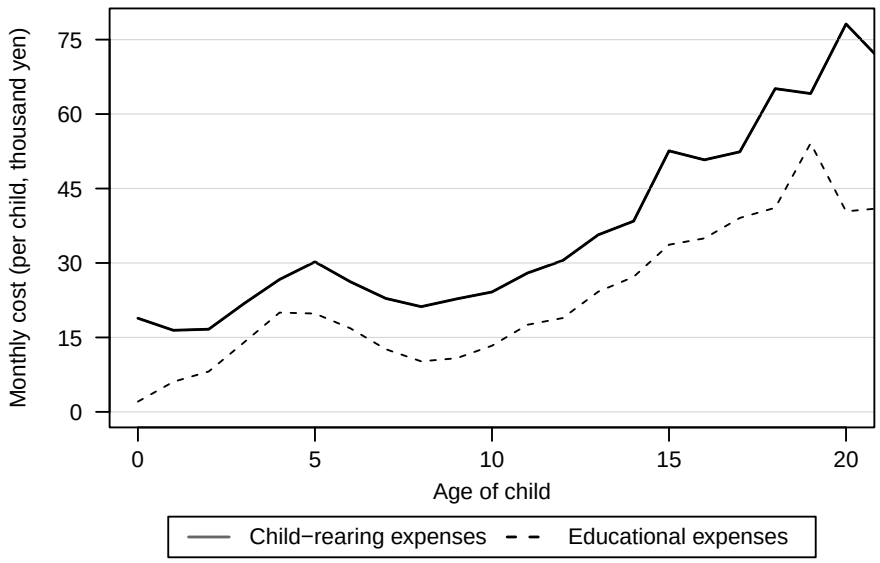

Figure 8: Child-rearing and education expenses by child age

Notes: Data from the JPSC (Panel Data Research Center at Keio University 2022).

Tables 4 and 5 show summary statistics for the key variable child-rearing costs. Note that these are summary statistics for the individually reported costs, while the measure used in our regression is a regional average constructed from these reported costs, as discussed earlier. We believe the mean cost in earlier cohorts is higher because child-rearing costs tend to rise with time (more children, more expensive schooling, increased income, etc.), and earlier cohorts contain a larger share of older women.

For an illustration of how the costs associated with child-rearing develop over a child's life, see Figure 8 which shows average child expenditures in single-child families. Also illustrated are the corresponding costs of education, which closely mirror the overall cost curve and constitute a growing share of the total cost over the child's life.

6 Expected costs: Child-rearing expenses and fertility outcomes

6.1 Method

When measuring fertility, it is common to use a fertility variable such as the cumulative amount children as the dependent variable. This is akin to asking how many children a woman is likely to already have given her age, and the characteristics of her lifestyle, family and living situation. One could also utilise a risk framework, phrasing the question in terms of how *prone* a woman is to have a child in the coming months or years. This manner of analysing the issue lends itself to our data, which is laid out in yearly intervals. Using the propensity, or risk, as the outcome also often means having binary dependent variables, which has the added benefit of yielding easily interpretable results.

Making the assumption that potential parents have a decision-making horizon of about one year, we use as our outcome a dummy variable indicating whether a respondent has a child in the subsequent period or not.

We consider the following specification of an ordinary least squares regression model:

$$Y_{i,s+1} = \alpha_m + \beta_m \textit{Child-rearing costs}_{rs} + \boldsymbol{\theta}_m \mathbf{X}_{is} + \nu_{is}. \tag{1}$$

$Y_{i,s+1}$ is a dummy variable taking the value 1 if respondent i has a child in year $s+1$. $\textit{Child-rearing costs}_{rs}$ denotes average child-rearing costs in region r in year s. $\mathbf{X}_{is}$ refers to a vector of covariates for respondent i in year s. ν_{is} denotes the error term. The intercept α_m as well as the coeffient β_m on *Child-rearing costs* and coefficients in vector $\boldsymbol{\theta}_m$ are allowed to vary between age groups m.

An OLS model with a binary response variable such as our own is referred to as a linear probability model (LPM), as it estimates the probability of an event occurring using a linear estimation. Other methods to estimate binary outcomes include the logit and probit models. We chose LPM for its easily interpretable coefficients.

Table 6: Regression results: Models I and II

	Model I				Model II			
	24–28	29–33	34–38	39–43	24–28	29–33	34–38	39–43
Child-rearing costs	−0.067**	0.040**	0.016	−0.004	−0.079**	0.036**	0.017	−0.006
	(0.030)	(0.016)	(0.010)	(0.007)	(0.032)	(0.017)	(0.012)	(0.007)
Employment	−0.037**	−0.019**	−0.027***	−0.008**	−0.020	−0.018	−0.140***	−0.021***
	(0.015)	(0.008)	(0.005)	(0.003)	(0.038)	(0.019)	(0.029)	(0.007)
Employment (spouse)	0.064	−0.007	0.030**	0.007	−0.046	0.113	0.170***	0.053**
	(0.039)	(0.023)	(0.013)	(0.010)	(0.197)	(0.138)	(0.058)	(0.022)
Earnings					−0.001	0.0004	0.010***	0.001
					(0.003)	(0.002)	(0.002)	(0.001)
Earnings (spouse)					0.009	−0.009	−0.011**	−0.004**
					(0.015)	(0.011)	(0.005)	(0.002)
Fixed effects	No	No	No	No	No	No	No	No
Observations	3,064	7,940	8,011	5,833	2,723	7,019	6,716	4,919
R^2	0.004	0.002	0.004	0.001	0.004	0.001	0.011	0.002
Adjusted R^2	0.003	0.001	0.004	0.001	0.002	0.0003	0.010	0.001

Notes: The outcome variable in all regressions in the table is *Birth in subsequent year*, taking the value 1 if a child is born to the respondent and 0 otherwise. Effects are estimated using robust standard errors. Data for the regressions are taken from the JPSC (Panel Data Research Center at Keio University 2022).Women below 24 are not surveyed and women above 43 are deemed have completed their fertility, and are thus excluded from the analysis. Significance is denoted by: *p<0.1; **p<0.05; ***p<0.01.

6.2 Results

In the following section, we provide regression results for five models of various specifications of equation 1. The dependent variable in each regression is a dummy variable indicating whether a child is born in the subsequent period. Models I through IV let the coefficients vary between age groups while model V lets them vary between parity groups. The age groups each span five years, beginning at age 24 since that is the youngest age of respondents in the survey and ending at 43, since very few children in the sample are born after that age. Parities are grouped at parity 0, 1, 2 and 3+, with 3+ indicating that women in the group have had three or more children. In Model I, only monthly child-rearing costs and employment for the respondent and the spouse are included in the regression. The variable of interest, monthly child-rearing costs, is logarithmic. It is statistically significant for respondents aged between 24 to 28 and 29 to 33, with a p-value below 0.01 for both. If the monthly regional cost of rearing a child increases by 1 percent, the likelihood of having a child decreases by 6.7 percent if the respondent is aged between 24 and 28 and increases by 4.0 percent if the respondent is aged between 34 to 38.

Respondent employment generally seems to lower the probability of having a child the following year. It is significant in all age groups and generally has a larger effect on younger respondents. If a respondent is employed, this lowers her probability of having a child by 3.7 percent if aged 24–28, 1.9 percent if aged 29–30, and 2.7 percent if aged

Table 7: Regression results: Models III and IV

	Model III				Model IV			
	24–28	29–33	34–38	39–43	24–28	29–33	34–38	39–43
Child-rearing costs	0.064	0.056	−0.020	−0.033	0.069	0.057	−0.022	−0.034
	(0.170)	(0.064)	(0.042)	(0.023)	(0.170)	(0.064)	(0.042)	(0.023)
Employment	0.239***	0.244***	0.111**	0.088***	0.191**	0.216***	0.087*	0.083***
	(0.082)	(0.036)	(0.050)	(0.030)	(0.094)	(0.042)	(0.052)	(0.028)
Employment (spouse)	−0.753	0.092	0.088	−0.011	−0.753	0.093	0.088	−0.011
	(1.075)	(0.453)	(0.108)	(0.021)	(1.070)	(0.452)	(0.108)	(0.021)
Earnings	−0.012	−0.015***	−0.006	−0.008***	−0.010	−0.014***	−0.005	−0.007***
	(0.008)	(0.004)	(0.005)	(0.003)	(0.008)	(0.004)	(0.005)	(0.003)
Earnings (spouse)	0.059	−0.014	−0.007	0.001	0.059	−0.014	−0.007	0.001
	(0.086)	(0.036)	(0.008)	(0.002)	(0.085)	(0.036)	(0.008)	(0.002)
Childcare leave availability					0.069	0.036	0.033**	0.008
					(0.065)	(0.026)	(0.015)	(0.006)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,723	7,019	6,716	4,919	2,723	7,019	6,716	4,919
R^2	0.430	0.294	0.318	0.336	0.431	0.294	0.318	0.336
Adjusted R^2	−0.090	0.004	0.068	0.102	−0.089	0.005	0.069	0.102

Notes: The outcome variable in all regressions in the table is *Birth in subsequent year*, taking the value 1 if a child is born to the respondent and 0 otherwise. The variable *Childcare leave availability* is a dummy variable indicating whether childcare leave is available at the respondents' workplace. It is interacted with the employment variable. Fixed effects for respondents and year. Effects are estimated using robust standard errors. Data for the regressions are taken from the JPSC (Panel Data Research Center at Keio University 2022). Significance is denoted by: *p<0.1; **p<0.05; ***p<0.01.

34–38. It has the smallest impact on the oldest potential respondents, where it lowers the probability by 0.8 percent. The employment of the spouse has no significant impact on fertility decisions in any of the age groups.

The coefficients of the variables above generally are smaller for the oldest age group and larger for respondents belonging to younger age groups. This implies that the effects of changes in the variables above are stronger for the latter as their propensity to bear children varies more.

However, both the R^2 and the adjusted R^2 are low, ranging from 0.1 to 0.6 percent, thus suggesting that the model is a poor fit to the data.

In Model II, the earnings of both respondents and spouses are added to the regression. With this specification, we still see a significant, positive effect of an increase in child-rearing costs on the first age group and a negative effect on the second, with coefficients of −0.079 and 0.036 for age groups 24–28 and 29–33. Both are significant at the 5 percent level.

Employment of the respondent only remains significant for the third and fourth age groups, and the employment of the spouse has taken on certain significance for the same two groups. If the respondent is aged 34–38 and 39–43, her propensity to have a child the following year increases by 17.0 and 5.3 percent, respectively, if her spouse is employed.

When examining the impact of the couple's earnings, the coefficients are only significant for the third age group (34–38) for respondents and the third and fourth age groups (34–38, 39–43) for spouses. For respondents aged 34–38, a 1 percent increase in own earnings raise the propensity to have a child by 1 percent, while a corresponding increase in spouse earnings lower it by approximately the same amount. For the last age group, there is a small negative effect associated with spouse earnings. This model also has low values of R^2 and the adjusted R^2, suggesting that richer specifications should be examined.

In Model III, respondent and yearly fixed effects are added, which significantly improves the fit and has large impacts on the estimates. While there is an increase in the values of R^2, ranging between 0.430 to 0.318, the adjusted R^2 is still quite low. This is often a sign of overfitting due to including excessively many explanatory variables, but in our case the low score could be due to the addition of individual fixed effects, which means including several thousand dummies. The adjusted R^2 penalises the inclusion of all these variables, which explains the low score. Controls for municipality size and educational attainment were also tested, but did not significantly improve the fit of the model

In this model, the coefficients on child-rearing costs lose their significance. Employment of the respondent is now significantly positive in all age groups, switching signs from the earlier specification. The effect is most significant in the younger age groups, where the coefficient is 0.239 for respondents aged between 24 to 28 and 0.244 when aged between 29 to 33. Coefficients on earnings have also switched signs, and are all significant at the 1 percent level for respondents in the second and fourth age groups (29–33, 39–43). Spousal employment and earnings have lost significance.

In Model IV, an interaction between respondents' employment and access to childcare leave is added to the regression. This has a very small impact on R^2 and adjusted R^2, as well as the coefficients on many of the other variables in the regression. The coefficient on the availability of childcare leave is only significant for the third age group containing respondents aged between 34 to 38. It indicates that the availability of childcare leave increases a respondent's propensity to have a child in the following year by 3.3 percent in addition to the 8.7 percent increase already in effect by being employed.

Model V replaces age groups m in Equation 1 with parity groups. For instance, in the group P0, the coefficients estimate the probability of having a child the subsequent year if the respondent is at parity 0 – that is, childless. In group P1, estimates concern having second births, and so on. The specification is identical to Model IV apart from the change to parity groups and the inclusion of an age control.

Also in this model the coefficients on monthly child-rearing costs remain insignificant. However, the employment status of the respondent is very significant for the first three parity groups, with p-values below 0.01. For the group P0, the coefficient is -0.554,

Table 8: Regression results: Model V

	Model V			
	P0	P1	P2	P3+
Child-rearing costs	0.026	−0.042	−0.005	0.004
	(0.062)	(0.039)	(0.009)	(0.012)
Employment	−0.554***	0.183***	0.078***	0.011
	(0.113)	(0.036)	(0.021)	(0.029)
Employment (spouse)	−1.458***	−0.382*	−0.083*	0.015
	(0.415)	(0.205)	(0.049)	(0.030)
Earnings	0.036***	−0.019***	−0.007***	−0.0004
	(0.010)	(0.003)	(0.002)	(0.003)
Earnings (spouse)	0.116***	0.028*	0.007*	−0.001
	(0.033)	(0.016)	(0.004)	(0.002)
Age	0.024***	−0.031***	−0.008	0.112***
	(0.005)	(0.002)	(0.005)	(0.004)
Childcare leave availability	−0.021	0.037**	0.004	0.002
	(0.024)	(0.017)	(0.005)	(0.005)
Fixed effects	Yes	Yes	Yes	Yes
Observations	3,580	5,827	12,357	5,647
R^2	0.620	0.470	0.468	0.183
Adjusted R^2	0.466	0.309	0.392	0.083

Notes: The outcome variable in all regressions in the table is *Birth in subsequent year*, taking the value 1 if a child is born to the respondent and 0 otherwise. Fixed effects for respondents and year. Effects are estimated using robust standard errors. Data for the regressions are taken from the JPSC (Panel Data Research Center at Keio University 2022). Note that age groups m in Equation 1 have been replaced by parity groups, ranging from parity 0, meaning childless, to parity 3+, meaning to have three or more children. Significance is denoted by: *p<0.1; **p<0.05; ***p<0.01.

indicating a negative impact on the probability of having a child the subsequent year if the respondent is employed and childless. However, while remaining significant, the sign changes in subsequent groups and the effect becomes positive instead, with an effect of 0.183 for respondents at parity 1 and 0.078 at parity 2. Spouse employment is also significant in the first two parity groups, with coefficients of −1.458 and −0.382 respectively.

There is a similar change in sign in respondent earnings as in respondent employment. Initially, there is a positive, significant effect in group P0 of 0.036. This implies that if a respondent is childless, a 1 percent increase in her earnings will increase her propensity to have a child the following year by 3.6 percent. The signs then switch to being negative, implying that a 1 percent increase in earnings decreases the probabilities of second births by 1.9 percent and third births by 0.7 percent.

Regarding the earnings of the spouse, the coefficients in groups P0, P1, and P2 are all significant to varying degrees. The coefficients are all positive at 0.116, 0.028, 0.007, respectively, which implies that as spouse earnings increase, so does the probability of a child being born the subsequent year.

Regarding the four different variables concerning employment and earnings of both the respondent and the spouse, there is also a pattern in terms of magnitude, as the coefficients gradually become smaller in size with each parity group. While not all coefficients are significant, such as those of the parity group P3, the pattern still indicates a tendency for employment and earnings to matter less in fertility decisions as respondents have more children.

For the variable examining the interaction of employment and access to childcare leave, only the estimate for parity group P1 is significant. With a positive coefficient of 0.037, it implies that employed respondents with one child are more likely to have another the following year if childcare leave is available.

Compared to earlier models, there is an increase in the values of R^2 and adjusted R^2, implying a better model fit.

Generally, the results in Tables 6, 7, and 8 above provide weak evidence for the hypothesis that high child-rearing costs discourage respondents from having children. In our specifications, the biggest determinants instead seem to be employment and earnings, both having significant impacts on our outcome.

7 Opportunity costs: Child penalties and labour market outcomes

Since the results from our expected cost approach were limited, we turn our attention to the issue of opportunity costs. Having established that a significant obstacle preventing potential Japanese parents from having a child is the cost of raising that child, we propose that the cost referenced by these parents is not limited only to the actual necessary expenditures associated with rearing the child but also includes opportunity costs, consisting of child impacts on various labour market outcomes. For instance, a new mother will take some time off work to have her child, and may then choose to postpone her return to work by taking some period of maternal leave, working only part-time, or taking on a more child-friendly job. In many cases, she may never return to full-time work after having children. While this example concerns employment, similar conclusions can be drawn for a variety of outcomes, also in the case of new fathers. These changes are generally smaller in magnitude for men, and we refer to the impact of children on women relative to men as the child penalty.[4] The magnitude of the child penalty and the mechanisms that drive it will clearly differ between countries due to institutional factors and cultural norms around the family, but to what extent is beyond the scope of this

[4]The term 'child penalty' is used throughout this paper because it is a standard term in literature. As in Kleven et al. (2019) we note that the question whether this effect should be viewed as a 'penalty' is up to interpretation. If it is driven by voluntary choices that ease child-rearing or are otherwise advantageous, such as taking on a new job with fewer hours and more generous maternity leave, there is clearly no penalty involved.

analysis.

While we cannot establish a quantitative link between child penalties and fertility decisions, we posit that such a link exists based on the results from the preceding analysis. Employed respondents are more prone to have children, implying that the stability of employment prior to pregnancy increases the propensity to have a child. However, respondents with higher earnings have a *lower* propensity of childbearing, implying that there is some weight placed on the opportunity cost of childbearing, quantified by one's earnings before having the child. To what extent a new mother loses out on her earnings is determined by the child penalty, which is what prompts us to perform the following analysis.

7.1 Method

We draw extensively from the event study approach employed by Kleven et al. (2019) in the following section. Unless otherwise noted, the methodology is entirely theirs.

To investigate the opportunity costs faced by potential parents, we look at the impact of first children on labour market outcomes for men and women, respectively. Fertility decisions are not exogenous, but the arrival of a child yields sharp changes in the relevant labour market outcomes which Kleven et al. argue are orthogonal to the unobserved determinants of those outcomes, since they ought to develop in a smooth fashion over time.

The data considered in this part of the analysis are the same as in the preceding section, but restricted to parents who have had at least one child. Since survey respondents are all women, we cannot observe any men unless they are married to a woman responding to the survey. Because of this, observed men (spouses) are always married, while observed women can be married, unmarried, divorced, or any other civil status. This marital self-selection for the men in our paper is not present in Kleven et al. (2019).

The year during which a parent has their first child is denoted by event time $t = 0$, and we observe event times ranging from -5 to $+10$, i.e., from five years before until ten years after the birth of the child. To preserve the maximum amount of the data set and to lessen any bias introduced by attrition we let the panel of parents remain unbalanced, unlike Kleven et al. (2019) who use a balanced panel in their main analysis. This means that not all individuals are observed for the full 16 years between event time -5 and $+10$ in our data.

The development of labour market outcome Y_{ist}^g for individual i of gender g in year s is studied over time by running the following regression separately for respondents (women) and spouses (men):

$$Y_{ist}^g = \sum_{j \neq -1} \alpha_j^g \cdot \mathbf{I}\left[j = t\right] + \sum_k \beta_k^g \cdot \mathbf{I}\left[k = age_{is}\right] + \sum_y \gamma_y^g \cdot \mathbf{I}\left[y = s\right] + \nu_{ist}^g, \qquad (2)$$

where the first, second, and third terms on the right-hand side denote full sets of dummies for event time, age, and year, respectively. ν^g_{ist} denotes the error term. The event time dummy for $t = -1$ is omitted to let the results measure the impact relative to the year directly preceding the birth. Even conditional on year and age, there is variation in event time driven by the fact that the age at which individuals have their first child varies.

We construct a pseudo-counterfactual outcome $\tilde{Y}^g_{ist}$ by taking the predicted outcome and omitting the contribution of the event time dummies, i.e., $\tilde{Y}^g_{ist} \equiv \sum_k \hat{\beta}^g_k \cdot \mathbf{I}\left[k = age_{is}\right] + \sum_y \hat{\gamma}^g_y \cdot \mathbf{I}\left[y = s\right]$. To convert the level effects into percentages, we compare the event time dummies to the pseudo-counterfactual by calculating $P^g_t \equiv \hat{\alpha}^g_j / E\left[\tilde{Y}^g_{ist} \mid t\right]$. Here, P^g_t shows the effect of children at year t for individuals of gender g compared to the counterfactual outcome absent children, in percentage terms.

The regression is run and the pseudo-counterfactual calculated for respondents and spouses separately. We then define the *child penalty* for women relative to men at event time t as

$$P_t \equiv \frac{\hat{\alpha}^m_j - \hat{\alpha}^w_j}{E\left[\tilde{Y}^w_{ist} \mid t\right]}. \tag{3}$$

The penalty measures in percentage terms how much respondents are lagging behind spouses in the outcome variable of interest at event time t due to children. As mentioned, event time $t = 0$ denotes the birth of the first child, meaning that the long-run penalty will include the effect of any additional children.

7.2 Results

The following graphs illustrate the gender-specific impacts of children, P^w_t and P^m_t, on various labour market outcomes across event times. Impacts on earnings, seen in Panel I, can come from three margins: working hours, participation rates and wage rates, seen in Panels II-IV. Included in the graphs are also 95 confidence bands and a long-run child penalty score, measured at $t = 10$. Results are relative to $t = -1$ as to measure the impact of children relative to the year prior to the first birth.

We see in Panel I that respondents suffer a substantial penalty in earnings while spouses face no perceptible impact. The long-run child penalty is measured at 0.353, meaning that respondents see a long-run earnings penalty of 35.3 percent compared to spouses. This penalty is driven by clear long-run decreases in the estimates for working hours and wage rates, which both remain stable for spouses.[5] The impacts are not as clear due to standard errors around the birth, but the lines and their corresponding confidence diverge somewhere around $t = 2$ for working hours and $t = 4$ for wage rates, with no sign of recovery.

Interestingly, respondent participation rate seems to completely recover and even

[5]The effects on working hours and wage rates are estimated conditional on labour force participation, meaning that any selection effects are included.

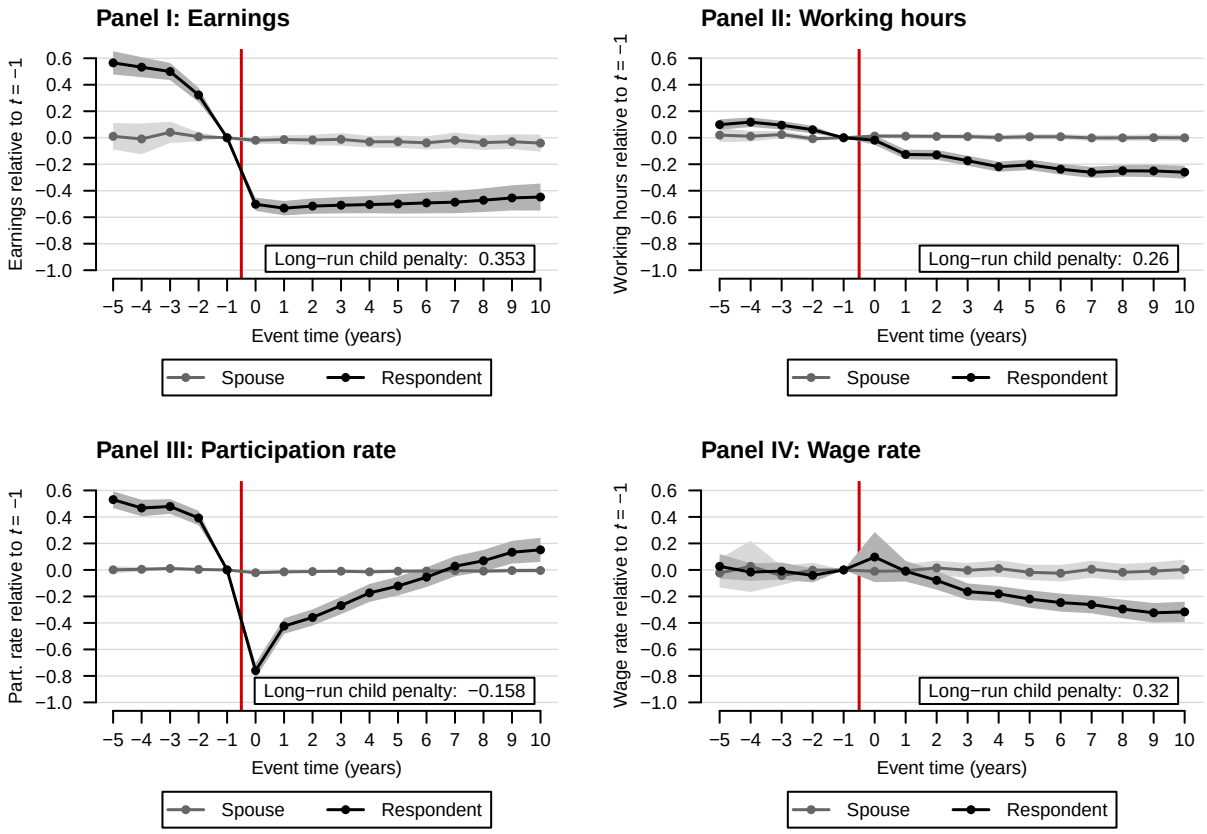

FIGURE 9: CHILD PENALTIES

Notes: This figure shows event time coefficients from $t = -5$ to $t = 10$ as a percentage of the constructed pseudo-counterfactual outcome absent children, i.e., $P_t^g \equiv \hat{\alpha}_j^g \,/\, E\left[\tilde{Y}_{ist}^g \mid t\right]$ for respondents (women) and spouses (men). There is also a 'child penalty' reported in each panel which is defined as $P_t \equiv (\hat{\alpha}_j^m - \hat{\alpha}_j^w) \,/\, E\left[\tilde{Y}_{ist}^w \mid t\right]$. This long-run child penalty is measured at $t = 10$. All statistics are estimated on an unbalanced sample of individuals who have had at least one child, taken from the JPSC (Panel Data Research Center at Keio University 2022). Respondents are women, which means that spouses (men) in the sample are only measured via their marriage to the respondents. This might introduce selection effects into the estimation of the spouse statistics. Earnings and participation are estimated unconditional on other labour market outcomes. Working hours and wage rates are estimated conditional on labour force participation. Shaded 95 percent confidence bands are based on robust standard errors.

go past the estimates for spouses, giving rise to a 'negative penalty' of −0.158. The interpretation of this is not as clear, but in terms of the specification of P_t, the positive impact of the event time dummy for $t = 10$ is *higher* for respondents than for spouses.

The results in Figure 9 are similar to those in Kleven et al. except for participation rates, which warrants further analysis to properly explain the observed penalty in earnings.

To do this, we decompose participation into various employment measures to see if respondents increasingly participate in certain kinds of employment following birth. We also check for impacts on managerial status, as in Kleven et al. (2019).

Panel V illustrates the employment rates among respondents and their spouses, rather than participation in the labour force. The trends are very similar to participation, in

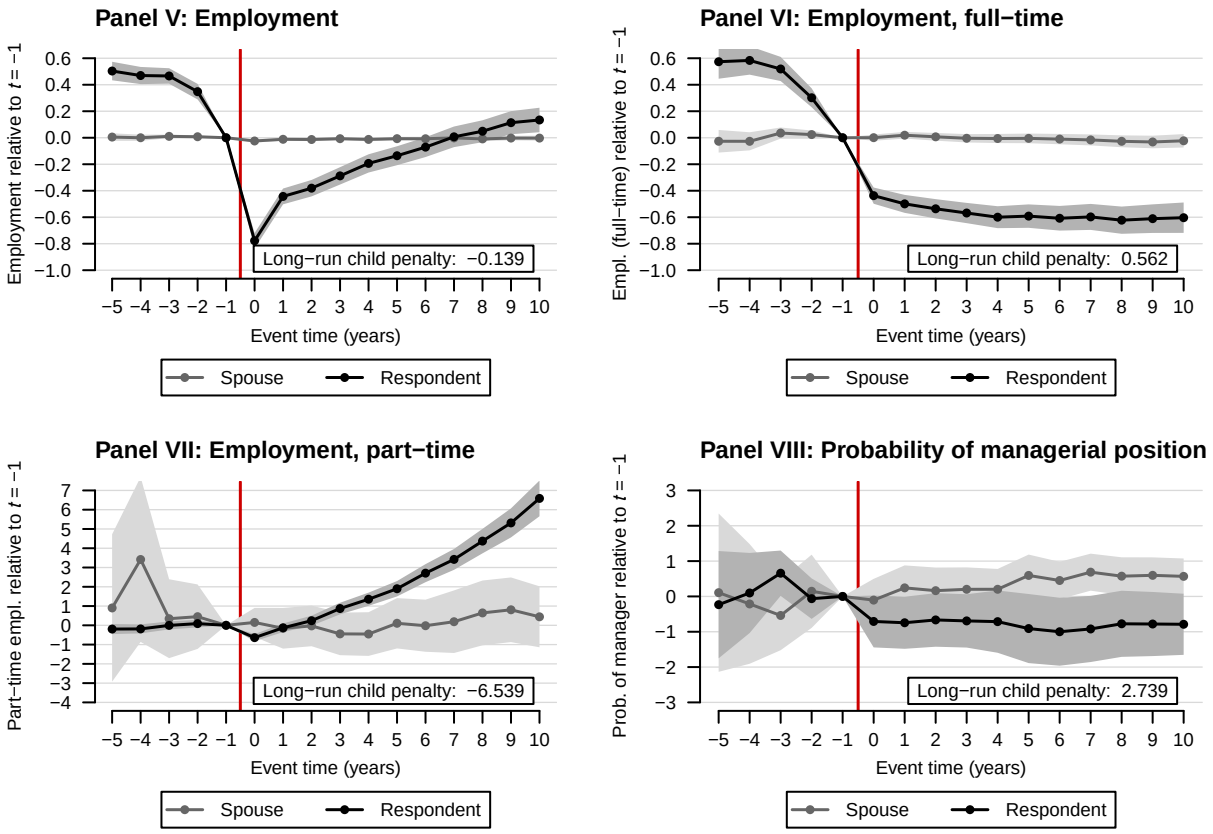

FIGURE 10: CHILD PENALTIES, CONTINUED

Notes: This figure is contructed in the same manner as Figure 9 and shows impacts of children on respondents and spouses, P_t^w and P_t^m. Effects in all panels are estimated unconditional on other outcomes. Data from the JPSC (Panel Data Research Center at Keio University 2022). Note that the scales on the y-axis on panels VII and VIII differ from earlier panels. Shaded 95 percent confidence bands are based on robust standard errors.

terms of pattern and relative value changes. The (negative) child penalty is only slightly smaller in magnitude than for participation.

Panel VI shows employment in full-time, regular work, which starts to decline already at $t = -3$, reaching a relatively stable path at around $t = 4$. This indicates that while many respondents return to some type of employment after birth, the number of individuals in full-time, regular positions falls after childbirth and remains low for the duration of the period analysed.

This is further illustrated in Panel VII, which plots part-time employment. The standard errors for the line of the spouse are very large, which makes interpretation slightly harder, but the respondent estimates give a clearer picture. The trend is flat until birth, where a small decline can be seen, after which there is a dramatic and continuous increase all the way until event time $t = 10$. Clearly, respondents increasingly go into part-time employment after the birth of their first child.

Another type of penalty is a lack of access to higher-ranking managerial positions,

which affects the wage rate and number of hours worked. As can be seen in Panel VIII, the trend of holding managerial positions decreases for respondents and increases for spouses following birth, although the standard errors are large due to the few managers observed in the data.

In Kleven et al. (2019), impacts of children are measured relative to $t = -1$, partly because of (1) the assumption that first births impact labour market outcomes at the time of the birth, and that those changes are orthogonal to the determinants of the outcomes in question, and (2) because trends generally were parallel for Danish men and women prior to the birth. While we still make the assumption that child impacts are orthogonal to the determinants of labour market outcomes, we do not observe the same parallel trends for event times $t < -1$. Instead, the lines for respondents in our data seem to start declining already at around $t = -3$ or $t = -2$. This can for instance be seen in the employment and participation estimates (Panels III and V), where the line for respondents starts at a higher point than for spouses, only to quickly decline from $t = -3$ and onwards. This implies that there is some effect before the year prior to birth, in relation to which the effects are currently estimated.

A possible explanation for this could be preparations in anticipation of birth. As birth occurs sometime between $t = -1$ and $t = 0$, preparations made just before or in the beginning of pregnancy could have an effect already at $t = -2$. Such preparations could include working fewer hours, switching to part-time employment, or leaving work altogether. The survey does record changes in one's occupational status, both termination of employment and changing employers, but there were not enough observations in the sample to find significant trends.

Another explanation could be marriage. As a woman gets married, it is possible that she decides to leave the workforce and become a stay-at-home wife instead, which then changes the trend before pregnancy or birth. The analysis of the impact of marriage on the lives of Japanese women deserves its own paper, but it is arguably larger than for Danish women, where views on marriage and the family are less conservative than in Japan. For our respondents, marriage is likely to entail not only gaining a spouse, but changing households, work and lifestyle. Could this play a part in explaining the trends? The average duration of time between marriage and the birth of a couple's first child is 1.63 years in our data. Combined with possible pregnancy effects, it is not unreasonable to think that the impacts of marriage and birth start to take effect on the lives of Japanese women already 2 to 3 years before birth.

Marriage and pregnancy effects on labour market outcomes are not controlled for in our regression. Since the early change of trend affects the long-run child penalty (which starts measuring the differences between the respondent and the spouse the year of the birth of their first child), we are likely underestimating the magnitude of the total penalty. For instance, participation rates not only recover, but surpass those of spouses,

when centering data around $t = -1$. Had we instead let the lines diverge already at, say, $t = -3$, the respondents would not have caught up to the spouses during the period concerned.

While a full analysis of this issue is beyond the scope of this paper, we have included versions of Panels I–VIII in Appendix B where the dummy for event time -3 has been omitted, letting the estimates measure the impact relative to that event time instead – that is, we let the event time dummy in Equation 2 equal $\sum_{j \neq -3} \alpha_j^g \cdot \mathbf{I}[j = t]$. We would like to emphasise this as a possible topic for future research – to examine occupational changes Japanese women undertake in years prior to birth as well as the impact of marriage.

8 Discussion

This section contains a discussion on our two sets of results. The first part of the section concerns the results from our expected cost approach in Section 6 and the second part of the section concerns results from our opportunity cost approach in Section 7.

8.1 Expected costs

Limited support for the effects of child-rearing costs. The coefficients for the child-rearing costs are only significant in our first two models. In those models, it is negative for those aged between 24 and 28, as expected, and positive for those aged between 29 and 33, which is unexpected. In the rest of the models, it is insignificant.

We attribute the lack of significant results mainly to the lack of variation in our average cost measure, whose lack of variation due to aggregation is especially apparent when we include fixed effects to improve the fit of the models, whereupon all significance goes away. A more granular and accurate measure would have been more appropriate.

The measure of child-rearing costs is not clearly determined or defined. What parents consider to be 'expenditures on the child' is not clearly outlined and may affect how respondents interpret and answer the survey. For example, possible issues could be that one-time or infrequent large costs are accounted for differently. Some may only include regular, expected costs, while some may try to do an average for the monthly costs, which in turn could be incorrectly estimated. Additionally, some parents may not monitor and record all expenses caused by a child, but enter an estimate in the survey, which could vary or be incorrect. Another potential issue is the unclarity regarding what to include as a child-rearing costs. Educational costs may not be properly accounted for, due to the different fees associated with them as well as their seasonality. Furthermore, it is not clear if respondents include increased household costs that arise from having children, such as housing or food expenses that can be attributed to children. Even if they are included, they are difficult to estimate correctly without strict monitoring, which is unlikely to

occur.

There are further issues caused by the fact that the survey only asks for the total expenditures for all children. This means that possible differences in expenditures between different children in the same family are not accounted for. Children may have different needs or in other ways incur different levels of cost. Additionally, as shown in Figure 8, children incur different levels of costs depending on their age. This is further complicated by the fact that children may need different levels of financial support depending on their birth order. For instance, a second child might be able to reuse clothing or other objects inherited from an older sibling. There is also a possibility of an income effect influencing the results. Affluent regions likely have higher average child-rearing costs but could also have higher fertility, assuming that affluence positively impacts the propensity to have children.

An ideal cost measure would be more granular, both geographically and temporally, as well as subdivided into various types of costs, notably education, childcare services, and healthcare.

Employment. The respondent employment variable has negative coefficients in models I–II, but positive coefficients in models III–IV. This indicates that our earlier specifications fail to accurately capture the effect of employment. In the later specifications with higher accuracy, employment gains what we deem to be a reasonable sign, indicating that if a respondent is employed, she is more likely to have a child the following year.

In Table 8, the coefficients related to employment switch from negative to positive when going from first births to second births. We posit that this is due to Japanese first-time mothers seeing employment as a hurdle to having a child since it may come at a time in their life when they want to keep working. In anticipation of a second pregnancy, the mother might feel more ready to stop working, resulting in a positive coefficient.

Earnings. Earnings are not significant until fixed effects are included in the regression. Then, it gains a negative sign which is significant for age groups 2 and 4. This tells us that as a respondent's earnings increase, her propensity to have a child decreases. This is in line with our previous discussion on opportunity costs and their effect on fertility. As earnings increase, so do the opportunity cost associated with leaving employment. By including both employment and earnings we attempt to separate the effect of 'just' being employed and being employed with high earnings.

The negative effect of earnings is lowered slightly by the availability of childcare services, which intuitively seems correct, as it should lower the opportunity cost of having children by allowing some women to remain employed while raising their children.

In Table 8, the sign switch on earnings is in the opposite order to the employment variable. For earnings, the sign is positive for first births, and negative for subsequent births. We interpret this as the income effect dominating for first births, and the substitution effect dominating for later births. That is, high-earning respondents with no children are

relatively more prone to want to have a first child, while high-earning respondents with one or more children are more likely to recognise the increased opportunity cost caused by their high earnings and be relatively less prone to have another child.

Childcare leave. The coefficients for the availability of childcare leave is only significant for respondents aged 34–38. A possible explanation could be that at that age range, it is most common to have your second child, and that those who are still working at that point are determined to stay in work, making childcare leave relatively more important for them.

Effects are smaller for older women. Generally, the coefficients seem to follow a trend where they decrease in magnitude in the older age groups. This is likely due to the fact that older women increasingly approach the point of completed fertility as they age, which means that all factors eventually lose significance since no more children are likely to be born. One could also say that the negative impact of age on fertility eventually dominates all other factors. Another possible explanation could be that older couples are more settled, enjoying more stable occupations and job security, and the aforementioned variables therefore have a lower impact on fertility decisions made. A similar pattern can be found in the parity decomposition in Table 8. Possible explanations could be the reasons outlined above, as women with more children are generally older.

8.2 Opportunity costs

As in Kleven et al. (2019), we find significant impacts on labour market outcomes for respondents (women) that are larger in magnitude compared to spouses (men) directly following the birth of a first child. Long-run child penalties, as measured at event time $t = 10$, for earnings, working hours, and wage rates are 0.353, 0.260, and 0.320, respectively, with corresponding graphs showing no signs of labour market recovery. Only for the participation rate can a recovery be seen, which yields a 'negative penalty' of -0.158 at the end of the analysed period. This negative result prompted us to estimate impacts relative to $t = -3$ as to explore the possibility of any pre-child effects. Graphs and discussion can be found in Appendix 9.

These penalties are entirely driven by negative impacts on respondents, while surveyed spouses face no obvious effects on the labour market outcomes in question. We thus conclude that we have found support for our hypothesis that Japanese women face higher opportunity costs of children compared to Japanese men.

The drop in earnings, which is stable at around -50 percent, seems to initially be driven by a drop in participation rates, which plummets to almost -80 percent directly following birth, while wage rates and working hours are not immediately affected. As we move along event times, the participation rate recovers at the same time as wage rates and working hours start declining, which keeps earnings down. This result differs from

Kleven et al. where all three margins seem to be roughly equal in importance for the determination of labour market outcomes for Danish parents, even in the later part of the analysed period (2019).

The recovery of participation rates for Japanese women is interesting, considering that the incompatibility of working and child-rearing is an oft-cited reason for the drop in fertility and a general problem for mothers in Japan. In our decomposition of employment types, we find that the recovery in participation rates is mainly driven by increases in part-time employment, while full-time employment falls drastically around the birth. As to why this recovery can be seen in Japan and not in Denmark, there are several possible reasons.

Firstly, the lack of childcare services is a well-known problem in Japan, which could make women return to work in part-time positions to a greater degree than in countries where services such as kindergarten would give more flexibility and allow them to work full-time while raising a small child.

Secondly, small family businesses are very common in Japan, employing immediate family members in enterprises such as restaurants, stores, and other service outlets (Uchida et al. 2023). We posit that a position in these types of firms are readily available for new mothers, allowing them to work part-time following the birth of their child.

Thirdly, while the survey question concerning employment does distinguish between being a housewife and working, there is a possibility that many Japanese women who do stay at home consider their daily chores a form of work, and may even receive a sort of salary from their husband, prompting them to denote themselves as employed. This *is* of course employment in the strict sense of the word, but may differ from what one thinks about in the context of Danish employment.

As discussed in the beginning of Section 7, we cannot establish a quantitative link between child penalties and fertility. We have, however, separately established (1) that Japanese women with high earnings have a lower propensity to have children, and (2) that Japanese women face a significant penalty in earnings after becoming mothers. In light of this, we argue that the cost referenced by Japanese parents as hindering them from having children is not only actual in nature, but also includes the opportunity costs of childbearing as quantified by the child penalty. The penalty is substantial, especially when comparing the outcomes of Japanese women to their Danish counterparts.

The policy implications of this are clear: not only is it reasonable to lower the *actual* costs of child-rearing by, for example, subsidising education and providing child support benefits, but attempts must also be made to lower the *opportunity* costs of children, as quantified by the child penalties new mothers face in the labour market. Concerning the latter, access to childcare leave, available and affordable kindergartens, and normative shifts regarding mothers in the workplace are all useful changes that come to mind.

We previously emphasised that the marriage market mismatch is an additional and

significant driver in the decline of Japanese fertility. While we will not make any claims concerning the cultural norms of Japan, as it is beyond the scope of our analysis, we would like to acknowledge the conflicting nature of marriage – which more often than not brings with it children – and Japanese women's increasing desire for continued employment. Does a woman who desires both to marry and to work until retirement age fare worse on the marriage market because of the incompatibility of her wishes? This line of reasoning is a possible avenue to further analyse the complicated problem of marriage in Japan, which our paper does not cover in detail.

9 Conclusion

Japan is on the brink of severe consequences because of its ageing population and dwindling birth rates. Using data from the Japanese Panel Survey of Consumers, we investigate to what extent the expected cost of child-rearing affects Japanese' families propensity to have children. We cannot find any conclusive evidence that such an effect exists using our constructed cost measure. We do, however, find strong links to employment and earnings. Using an event study approach, we then investigate the effects of having children on labour market outcomes and find that there are large effects on women while men are largely unaffected.

Our first set of results concerns expected costs. Using a measure for child-rearing costs constructed by averaging yearly regional costs from the JPSC, we could not find any significant effects. Instead, we focused on the significance of employment and earnings, the former of which raises women's propensity to have children while an increase in the latter lowers it.

Our second set of results concerns opportunity costs. Using an event study approach centered around first births, we found significant effects on labour market outcomes for women in our sample. The long-run child penalty on earnings, measured 10 years after the birth, was estimated at approximately 35 percent for women when comparing to men, who faced no significant effect. A recovery in participation rates for women was shown to be driven by large increases in part-time employment.

The exploration of opportunity costs in the second part of our analysis was in part driven by the limited results of the first part. We cannot establish a quantitative link between the two in this paper but argue that the costs cited by many Japanese as hindering them from having children include not only actual expenditures on children, but also the child penalties that we have shown do exist and are persistent in the long-term.

The child penalties seen in labour market outcomes for women are not only driven by the nature of the labour market and Japanese working life, but also by norms surrounding the family in Japan, and can be a result of choices that women make. We do not draw any normative conclusions in this paper or make any comment on the family culture of Japan.

However, we want to emphasise that our results have policy implications for those who *do* see labour market effects as a penalty and *want* to work alongside child-rearing. As desires to be a housewife or stay-at-home mom decrease among Japanese women, steps should be taken to lessen the impact of children on those who want to work. Potential measures include availability of childcare leave in all workplaces, geographical and economic access to kindergarten or other child services, subsidies or grants for educational costs, and other such initiatives.

Continued work on the issue of Japanese fertility should concern what specific measures might alleviate the child penalty and to what degree culture and norms play a role in family and lifestyle decisions.

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Appendix A: Variable construction methodology

The JPSC, from which the primary data set in this paper is drawn, contains many variables. Some variables can be used as is, while other variables have been adapted or created from scratch based on survey answers. Below is a brief description of the variables that were adapted or changed in any way as well as those that we created from several survey answers.

Expected cost of child-rearing. Using the monthly expenses related to children, we construct an expected cost of child-rearing by taking the regional average each year. This average is constructed using a leave-one-out method, so each individual family's own child-rearing cost is not included in the expected cost that they are assigned. The average is constructed by summing the total costs for one region in one year, and then dividing it by the total number of children in the same region during the same year.

Region. Japan has a number of regional administrative classifications, most notably its 47 prefectures. While prefectural division of data observations would be preferred, the prefectural code of survey respondents is censored for undergraduate users of the JSPC. Instead, we use a less granular geospatial variable assigning respondents to one of 8 regional blocks – Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku or Kyushu. There was also a ninth group containing respondents living in other countries or regions of Japan – most notably, the islands of Okinawa – but this group was removed because of a lack of data points and lower applicability of any results. Regions are not used in of the any regressions because of possible multicollinearity with the child-rearing cost variable. It is, however, used in constructing that variable.

Parity. The parity of a woman is the number of live children she has given birth to so far. The data set contains a birth order variable that is filled in only for years when a given woman gives birth to a child, denoting which order of child the newborn was. Such a variable could be used to construct a corresponding parity variable, but it would suffer from left censoring since birth order information on women who already have children is not recorded until she has a child, and would not be suitable since the specific survey question does not distinguish between third and later births. Instead, we construct a birth order variable based on reported family composition, which is a set of variables describing all family members living in the household, including any children who have moved away for studies, marriage or any other reason. Based on this information, we can distinguish between women of parity zero, one, two, three, and four as well as those of parity five and up.

There are some potential accuracy issues with this measure. First is the issue of child mortality. If a child in the household dies, there is no stipulation in the survey on how the household composition answers should change. For instance, if the oldest child in a two-child family dies, the respondent might start labelling the remaining child "my first

child" in the survey, indicating a parity of 1, even though this child is second-born and likely was labelled 'my second child' in the preceding survey. The second issue is that of adoption and step-children. Both are ways through which a child can enter the household without being born by the respondent. While adopting a young child likely gives rise to similar costs as raising one's biological child, save for adoption costs, adopting an older child or even an adult – as is common in Japan in order to secure heirs (Mehrotra et al. 2013) – does not come with the same expected costs.

While it should be noted that both child mortality and adoption/step-children would cause measurement error in the data, we do not anticipate that this will have any noticeable impact on our results, because (1) child mortality is rare in Japan, as in many developed countries (Mishina et al. 2013), (2) parents are likely to see their second-born as their second child, even if their first child has died, and (3) there is a personal relationship category in the survey denoted as 'Other', which likely encompasses adoptive children for most families, especially if the adopted individual is an adult.

Birth in subsequent year. This variable takes the value 1 if one or more children is born in the subsequent year to a respondent, and 0 otherwise. Since survey rounds are every October, 'subsequent year' refers to the 12-month October–September period following the answering of the survey, or more exactly, between the date of answering the current year's survey and the date at which the next year's survey is answered. In the rare case of twins/triplets/etc. or if two children are born less than 12 months apart during the subsequent year, this variable will still take the value 1, since *a* child was born, but the parity of the woman in question will increase by more than one since more than one child was born. This is our outcome variable in all regressions in Section 6.

Employment. For both respondents and spouses, two questions on employment status were asked. The first one differentiated between working and other categories, such as being a student or a housewife. Individuals who were denoted as working in this question were labelled as employed. The second question differentiated between different types of employment, including full-time, part-time and self-employed, among others. Since all categories implied employment of some sort, all individuals who responded to that question were also labelled as employed.

Employment, full-time. Using the second question on employment from above, regular full-time work could be distinguished from all other forms of employment.

Labour force participation. A common definition of being in the labour force is to either be employed, be unemployed but actively searching for work, or ready to start working. Using that definition, we denote an individual in our data as being part of the labour force if they are employed, currently searching for work, or undergoing job training. We assume that job training is connected to employment.

Weekly working hours. The survey question on working hours contained 10 bins of varying size, with the last bin being uncapped (<15, 5–21, 22–34, 35–42, 43–45, 46–48,

49–54, 55–59, 60–64, >65). To construct a numerical value for working hours, the variable was set to the middle value of each bin, except for the last one, which was set to 65. For those denoted as part of the labour force but not currently employed, the hours were set to 0.

Earnings. Individuals in the survey were classified as being paid a monthly, daily, or weekly salary. To construct a common earnings measure, all salaries were adjusted to reflect monthly earnings. Monthly salaries could be used as is. Daily salaries were multiplied by 20.58, the average amount of working days per month in the Japanese calendar. Hourly salaries were multiplied first by the weekly working hours mentioned above, and then by 4.345, which is the average number of weeks in a month. Earnings were set to 0 for all who were unemployed or not part of the labour force at the time of the survey.

Wage rate. We obtain an estimated wage rate by dividing earnings by working hours. Since only those in labour force have known working hours, the wage rate is estimated conditional on labour force participation.

Appendix B: Child penalties relative to $t = -3$

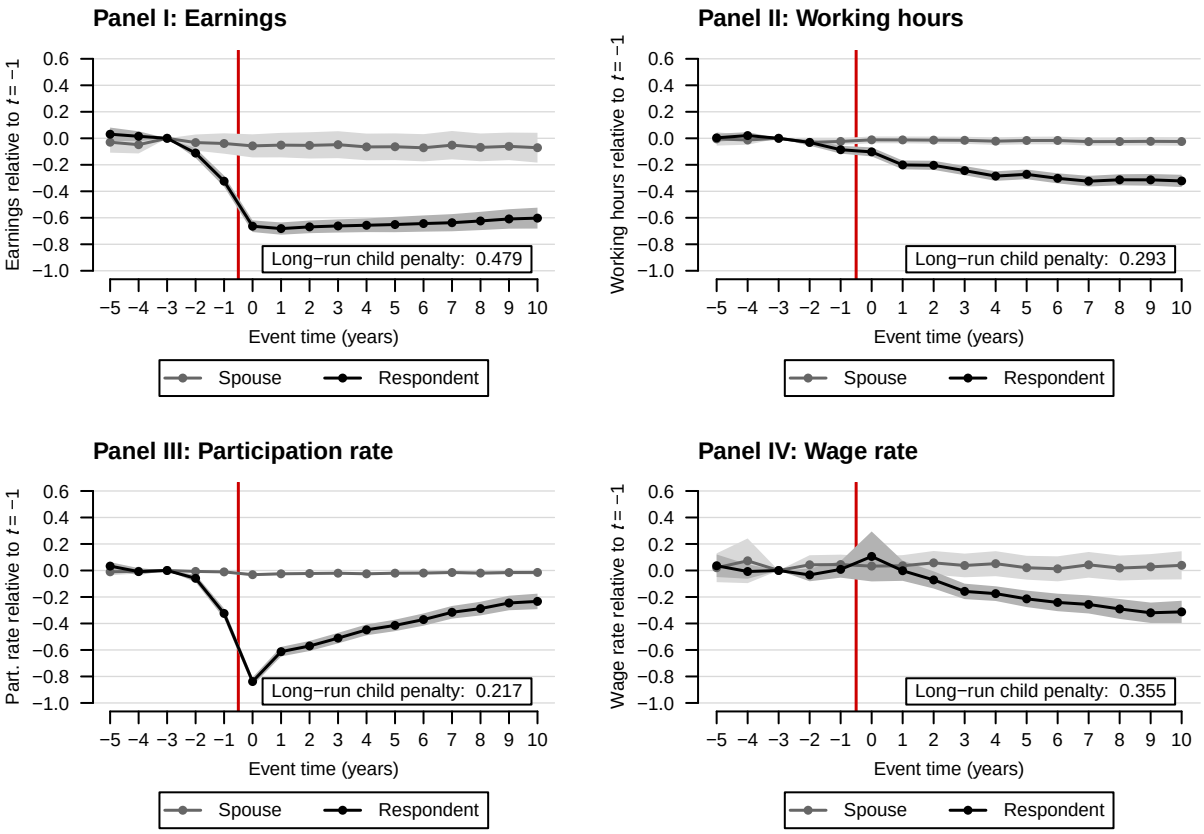

FIGURE 11: CHILD PENALTIES RELATIVE TO $t = -3$

Notes: This figure is contructed in the same manner as Figure 9 and shows impacts of children on respondents and spouses, P_t^w and P_t^m, but having the reference event time as $t = -3$. Effects in all panels are estimated unconditional on other outcomes. Shaded 95 percent confidence bands are based on robust standard errors. Data from the JPSC (Panel Data Research Center at Keio University 2022).

In the main analysis, the figures illustrating child penalties were constructed in the same manner as in Kleven et al. (2019), omitting the dummy for event time $t = -1$ to let effects be estimated in relation to the year directly preceding the birth of a first child. To illustrate possible pre-child effects consisting of both effects in preparation for and during marriage and pregnancy, we provide versions of our earlier graphs where the following equation has been run to create the estimates:

$$Y_{ist}^g = \sum_{j \neq -3} \alpha_j^g \cdot \mathbf{I}\left[j = t\right] + \sum_k \beta_k^g \cdot \mathbf{I}\left[k = age_{is}\right] + \sum_y \gamma_y^g \cdot \mathbf{I}\left[y = s\right] + \nu_{ist}^g. \tag{4}$$

It differs only from equation 2 in that it omits the event time variable for $t = -3$ instead of for $t = -1$.

The shape of the graphs are almost exactly the same, which is natural considering that the only difference really is a 'recentering' of the reference year. With that change we now see parallel trends in the first event times, akin to the graphs in Kleven et al. (2019),

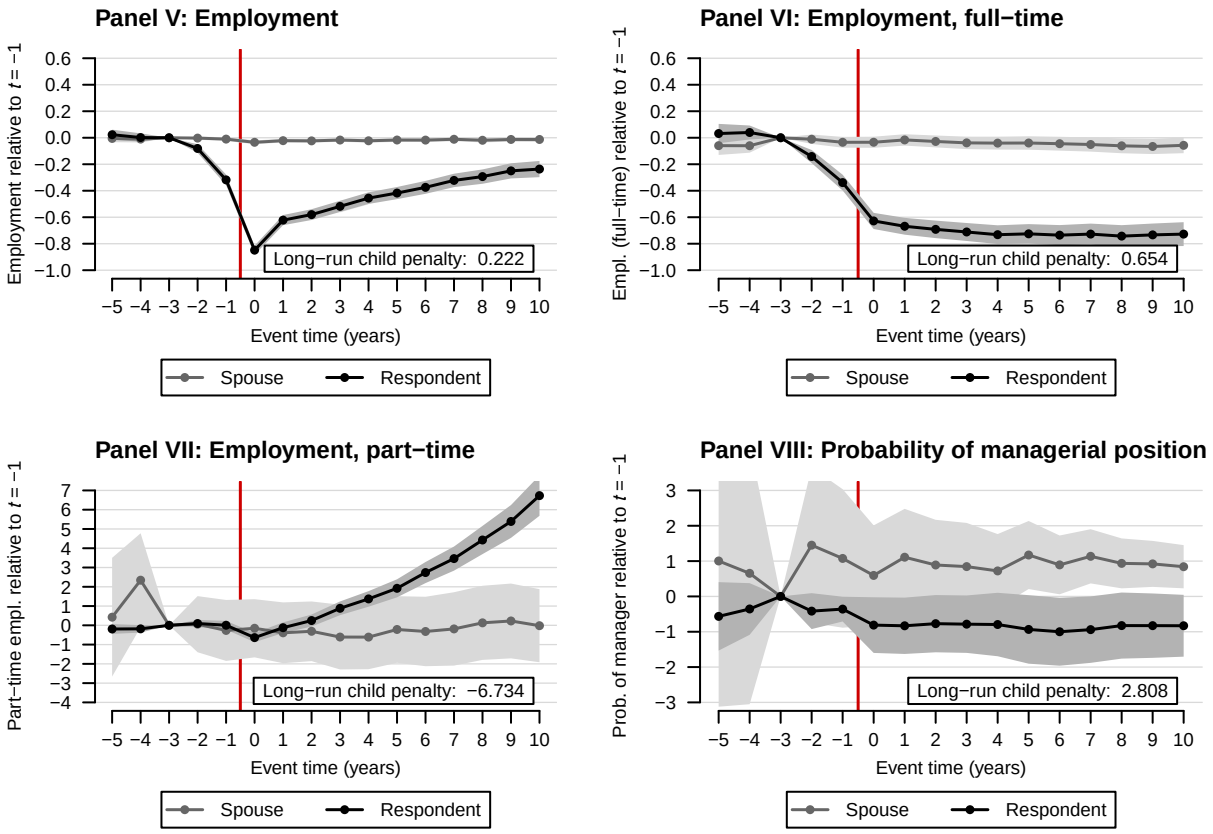

FIGURE 12: CHILD PENALTIES RELATIVE TO $t = -3$, CONTINUED

Notes: This figure is contructed in the same manner as Figure 9 and shows impacts of children on respondents and spouses, P_t^w and P_t^m, but having the reference event time as $t = -3$. Effects in all panels are estimated unconditional on other outcomes. Shaded 95 percent confidence bands are based on robust standard errors. Note differing y-axis scales in Panels VII and VIII. Data from the JPSC (Panel Data Research Center at Keio University 2022).

and then sharp changes going from $t = -3$. With this setup, the long-term child penalty in earnings is now 48 percent, up 13 percentage units from earlier. Similar increases can be seen in the three margins affecting earnings, and the 'negative penalty' observed in participation earlier is now gone, a long-run penalty of 22 percent taking its place.

The results observed in this graph are only supplied as suggestive evidence that marriage and pregnancy have effects on labour market outcomes in addition to the birth of children. However, no causal links can be made because this analysis violates the assumptions of sharp changes in outcomes around event time $t = 0$.