Life Satisfaction as a Causal Determinant of the Second Parity Progression

By

Sang Hoon Jee

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

MASTER OF DEVELOPMENT POLICY

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Approval as of May , 2016

ABSTRACT

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Finding ways to reverse the low fertility trend across developed countries are becoming a national priority. Although there are many possible angles to view this problem, here the issue of low fertility was taken as a matter of personal choice, especially so for a second child. Based on this premise, it was determined that critical but often neglected determinant of fertility behaviors was the life satisfaction, which is an integral aspect of human life that can not only reflect a person's living situation but also affect one's future behavior. To elucidate the potential causal influence of life satisfaction on fertility outcomes, various estimation methodologies including ordinary least square and instrumental variables analyses were utilized on a well-known panel dataset (the British Household Panel Survey). The findings in general were as expected across main analyses and robustness checks. Average level of and amount of drop in life satisfaction around the period of first child birth were positively and negatively associated with probability of having a second child, respectively. Based on the results obtained, implications and limitations were discussed.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincerest gratitude for Professor Shun WANG for supervising and guiding me through the thesis process. Without his keen insight and constructive comments, this thesis would not have been possible. Also, I would like to thank Professor Seulki CHOI who, as a second supervisor, provided me with valuable comments that stimulated ideas and explorations. In addition, I would like to mention excellent administrative support that student and academic affairs have provided. Their exceptional assistance made the life at school a pleasant experience. I would also like to thank fellow classmates of KDI School for inspiring and motivating me to move forward. With their encouragement and support, I was able to persevere through the process. Additionally, I would like to especially thank Professor KIM Jung Hee for mentoring me in many ways. Finally, I thank my family for giving unconditional support during my study.

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I. INTRODUCTION

In the last few years, the issue of subjective well-being received more attention across developed nations than any other period in recent history. The United Nations Secretary General Ban Ki-moon, for instance, launched the International Day of Happiness in 2012 as a recognition of the importance of considering subjective and objective dimensions of well-being in policy goals (United Nations, 2012). Indeed, there are clear signs of nations beginning to accept such changes in the trend, which can be noted from fervent advocacy for and adoption of happiness as a supplementary indicator to the gross domestic product in measuring societal well-being (e.g., Hicks, 2011; Stiglitz, Sen, & Fitoussi, 2009). In light of this modern development, it seems timely to consider potential impacts that the subjective well-being may have on various domains of life and on national interests. Here, specific focus was placed on the issue of low fertility among advanced economies. In South Korea, for example, the continuation of its low fertility rate trend would expect to result in substantial structural changes in the society due to rapid rise in old-age dependent group while declining work-age group (Lee, 2012), generating heavy burden for the society in foreseeable future (Park & Hong, 2011). To amend the current negative trend, it is important to recognize the fact that fertility decision has become a matter of choice for majority of people rather than a social expectation in modern developed societies (Aarssen, 2005; Hakim, 2003). This in essence points to the potential role life satisfaction may play in determining fertility intention and eventual outcomes. Evidence supporting this line of thinking has been accumulating (e.g., Margolis & Myrskylä, 2015; Parr, 2010), but there is still much to be gained from in-depth and especially causal investigations. More specifically, it is not entirely clear whether first child experience affects subsequent fertility behaviors and whether life satisfaction of an individual plays any part in shaping such experience. Thus, to fill this knowledge gap, the present thesis investigated the relationship between an individual's life

satisfaction around the period of first child and second parity outcomes. It was found that level of life satisfaction can positively and substantially affect probability of having a second child, which may act potentially through its influence over fertility behavioral beliefs. Likewise, it was determined that the negative fertility experiences as represented by greater decline in the life satisfaction across the period of having the first child could have lasting impact that hinder further fertility behaviors. In the following sections, theoretical rationale, methodological discussions (Section II), results of analyses (Section III), discussion of findings (Section IV), and finally, conclusion were presented (Section V).

1.1. Subjective Well-Being as a Measure of Life Circumstances

Subjective well-being (SWB) is a broad concept that reflects an individual's subjective state. It differs from objective well-being indicators such as income and social status in that the SWB is largely grounded in the individual's perception of one's life circumstances (Diener & Suh, 1997). Although the precise definition of the SWB may vary depending on academic disciplines (e.g., life satisfaction, utility, and so on), the general consensus developed over the years is that the SWB should be seen as a multi-dimensional construct, which, in its most fundamental sense, can be decomposed into three factors: a) cognitive, b) affective, and c) eudaimonic dimensions (Dolan & White, 2007; Organization for Economic Co-operation and Development [OECD], 2013). In brief, cognitive dimension is conceived as a retrospect evaluation of life as a whole in which individuals compare their life experiences against their own internal standards of how it should be (Pavot & Diener, 1993; Pavot, Diener, Colvin, & Sandvik, 1991). This cognitive aspect of the SWB, also more commonly known as life satisfaction, is normally measured by asking survey respondents with a simple question such as "considering life as a whole how satisfied are you with your life?," and the responses are recorded in a Likert scale that typically ranges from 3- to 11-point (e.g., the British

Household Panel Survey [BHPS] and German Socio-economic Panel [G-SOEP] [Dolan, Peasgood, & White, 2008]). As can be seen from the question, in addition to evaluation of the life itself, the cognitive dimension necessarily encompasses a temporal aspect as well because it is a retrospective measure. However, the life satisfaction measure does not explicitly aggregate subjective experience over specific durations (in comparison to the 'experienced utility' [Kahneman, Wakker, & Sarin, 1997]). Rather, people's life satisfactions are implicitly assumed to be determined through an integration over a subjectively determined time period (Dolan, Paul, & Metcalfe, 2011; Dolan et al., 2008; Kahneman & Riis, 2005). In essence, it can be said that people evaluate their lives based on what they remember of them (also known as "remembered utility" [Kahneman & Riis, 2005]). Assuming that people attempt to make decisions to maximize their life satisfaction (or utility), this points to an important behavioral implication as their decision making will largely be governed by their judgement of potential benefits in this cognitive dimension of SWB that behaviors may elicit (Kahneman & Riis, 2005). In addition, another notable point to consider is that there are sub-categories comprising the overall life satisfaction called domain life satisfaction (Van Praag, Frijters, & Ferrer-i-Carbonell, 2003). They generate more nuanced and complete picture as to how and with what aspect of life a person is satisfied with. In this sense, the overall life satisfaction question can be understood as a question that subsumes specific domain life satisfactions. Therefore, as a whole, the overall life satisfaction measure may lack the specificity with regards to its responses for a particular life event and an outcome of a behavior, but precisely because it is a general response and because people's internal weight of sub-domains may change with life events (Wu, 2009), it may turn out to be more perceptive measure than domain life satisfactions if an event alters many aspect of a person's life (e.g., having a child).

Another aspect of people's SWB has to do with affect or positive and negative emotions such as happiness, joy, and anxiety (OECD, 2013; Pavot & Diener, 1993). Importantly, the affective aspect is considered to be experienced emotions at a particular moment in time (OECD, 2013), meaning it is conceived as more transient part of the SWB (Dolan et al., 2011) that can fluctuate even hour to hour (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). This feature conceptually distinguishes the affective dimension from the evaluative dimension, which is based on remembered experiences (Kahneman & Riis, 2005), and is generally considered more stable (Helliwell, Huang, & Wang, 2015; Schimmack, Diener, & Oishi, 2002), for instance, against daily fluctuations (e.g., no weekend effect for the cognitive dimension [Helliwell & Wang, 2014]). This separability in turn indicates that the affective dimension may reflect life circumstances differently than the cognitive dimension. More specifically, it has been shown that while life satisfaction is related with various life episodes such as unemployment spells, retirement, and marriage as well as with income, the emotional dimension of the SWB has not demonstrated as strong links with the aforementioned factors (Kahneman et al., 2004; Knabe, Rätzel, Schöb, & Weimann, 2010). This may possibly be due to the fact that life events are more salient and relevant for the cognitive evaluation than the affect counterpart because experienced emotions do not rely as much on comparison with internal standards[1] (Kahneman et al., 2004). Regardless of the reason, this suggests the need for caution in selecting specific SWB measures depending on the question of interest.

Finally, the eudaimonic dimension is related to the idea that functioning and fulfillment of purposes in life are important constituents of SWB (Huppert & So, 2013). Independent of above two dimensions, the eudaimonic aspect of the SWB could potentially plays a key role in determining prospective behavioral decisions and their consequences since it also concerns

[1] In other words, how changed life circumstances measure up to previous case

with capacity to achieve in addition to assessment of individual's current state (OECD, 2013), making it potentially important variable to consider in analyses of behavioral decision making.

Considering all three dimensions, it was determined that a specific focus should be placed on the cognitive dimension for several reasons. Firstly, the eudaimonic dimension was excluded from the consideration as a predictor variable in this thesis because of its relatively weaker theoretical and empirical research bases (OECD, 2013) and because of the difficulties in accessing longitudinal eudaimonic data. In comparison, the data on life satisfaction have been collected for a long period of time (e.g., the BHPS and G-SOEP). Thus, given these constraints, the use of accumulated life satisfaction data provides relative advantage over the eudaimonic dimension by enabling use of more sophisticated longitudinal research methodologies to uncover causal relationships. Secondly, another major reason for the emphasis in the life satisfaction was because, in contrast to the affective dimension, the cognitive aspect tends to show greater stability against short-term fluctuations, which translates into the life satisfaction measure being more apt at reflecting changes in life circumstances (Helliwell et al., 2015; Helliwell & Wang, 2014; Kahneman et al., 2004; Schimmack et al., 2002). In other words, for understanding long-term implications of significant behaviors such as childbearing and childrearing on people's lives, the cognitive dimension may be better than the affect counterpart due to lesser short-term noise contained in the data. Thus, with these points in mind, it was deemed appropriate to define the SWB in terms of the cognitive dimension (life satisfaction)[2] for the purpose of this thesis.

[2] Henceforth, life satisfaction will be used synonymously as the subjective well-being.

1.2. Subjective Well-Being and Life Perspectives

In the previous section, it was discussed that the life satisfaction measure represents overall life circumstances of a person. However, it is just as important to understand that the life satisfaction itself can also act as a modifier and a driver of human behaviors. More specifically, as a modifier, a person's level of life satisfaction can affect how the person perceives outcomes of life events. For example, a research on how people recover from natural disaster has indicated that those with higher life satisfaction tend to perceive less stress and have more positive energy when confronted with natural disaster (Tremblay, Blanchard, Pelletier, & Vallerand, 2006). This is consistent with the findings showing negative relationships between life satisfaction and pessimism as well as between life satisfaction and physical as well as emotional exhaustion (Brand et al., 2010), meaning that adverse situations may affect people with high life satisfaction less severely. Furthermore, in an experimental study, it has been shown that people with higher life satisfaction are biased towards perceiving positive emotional stimuli more strongly than negative counterparts while those with low life satisfaction displayed opposite tendencies with stronger bias towards negative stimuli (Robinson & Hippel, 2006). This heightened perception towards positivity among satisfied people (and vice versa) may explain the mechanism through which life satisfaction may generate optimism and perseverance. Indeed, behaviorally, those with higher life satisfaction also showed greater likelihood of persisting through college (Frisch et al., 2005), and inducing positive affect (i.e., happiness) resulted in greater preference for longer-term perspective (Ifcher & Zarghamee, 2011). These results imply existence of greater willpower among generally satisfied people to help them resist gratification now for greater future benefits. As a whole, then, these findings strongly implicate that perhaps through a feedback loop, life satisfaction itself may be related to how people judge their life circumstances especially those related to future prospectives. Therefore, when people have

high life satisfaction, they may not only be satisfied with their lives in general but may also perceive subsequent life events in more positive ways even in the face of difficulties, ultimately contributing to maintenance of or even improvement in their level of life satisfaction. The process above outlines how life satisfaction can affect evaluations of current behaviors (or their outcomes), but to fully understand the role SWB plays in driving fertility behaviors, it is necessary to further expand theoretical framework.

1.3. Theory of Planned Behavior as a Model Predicting Behaviors

One of the fundamental characteristics of childbearing in modern developed societies is that it is largely a matter of reasoned choice. For example, across countries, wide spread of contraceptive use (Bailey, 2009), access to legalized abortion (Levine, 2004), and improvements in the social status of women in general (e.g., through greater education [Cygan-Rehm & Maeder, 2013; Skirbekk & Samir, 2012] and empowerment [Aarssen, 2005; Upadhyay et al., 2014]) all have led to significant decline in total fertility rate and more importantly, have transformed the nature of childbearing behavior from a social responsibility to a personal choice (Aarssen, 2005; Hakim, 2003). Based on the premise that fertility behavior is a reasoned response of each individual, then it becomes obvious that the fertility behavior can be influenced and changed given right circumstances (e.g., as opposed to if it is based entirely on personality or society). More specifically, because a person's attitude towards a behavior has long been considered as an indicator of intention for the behavior (Ajzen & Fishbein, 2005), the fertility behavior as a reasoned action would in turn imply that an individual's opinion or attitude towards having children would be a critical determinant of one's fertility outcomes (Ajzen & Klobas, 2013; Klobas & Ajzen, 2015; Mencarini, Vignoli, & Gottard, 2015). Thus, to promote positive fertility outcomes among people, it becomes

imperative to explore the causes of attitude formation especially. To this end, the theory of planned behavior (TPB) proposed by Ajzen (1985) may be the most appropriate.

1.4. Basics of the Theory of Planned Behavior

Understanding and predicting behaviors of people have been prolific areas of research in psychology; as such, there have been a number of generalized theories that attempted to describe human behaviors, but the theory of planned behavior (TPB), in particular, has received much attention over the years as one of the most prominent theories in its field (Ajzen, 2011). Its theoretical rationales and structures are well fleshed out, and accumulated empirical evidence testing the theory has also generally supported the theory within its boundary conditions, validating its suitability as general theory of human behaviors (Ajzen, 2011, 2012; Ajzen & Fishbein, 2005). Furthermore, much efforts have been placed in expanding its theoretical and practical grounds to explain fertility behaviors in recent years (Ajzen & Klobas, 2013; Klobas & Ajzen, 2015; Mencarini et al., 2015). Although evidence from empirical studies exploring the TPB framework in fertility behaviors is still quite thin, all in all, these reasons make it especially appropriate and timely to consider the TPB in predicting fertility outcomes in this thesis.

In brief, as can be seen in Figure 1, the TPB has several components that independently contribute to the prediction of a behavior[3], namely the direct antecedents are: a) attitude, b) subjective norm, and c) perceived behavioral control (Ajzen, 1991). Although each of three factors explains different channels through which human behaviors are reached, the attitude

[3] Here, intention was ignored for two reasons. Firstly, although studies show that intention do not perfectly predict the actual behavior, it can be seen as a close proxy since it lies in causal sequences and meta-analysis tend to show high correlations between intention and behavior across many domains (Ajzen, 2012). Secondly, for the purpose of this thesis, the distinction was largely irrelevant as the behavioral outcome was directly measured (having a second child). Thus, for the sake of simplicity, intention was treated as synonymous to behavior and any specific discussion of intention to behavior relationship was avoided.

may warrant special attention in the context of this thesis because as will be outlined in the following sections, life satisfaction (SWB) may affect the fertility behavior, at least partially, through the attitude channel. Formally, attitude is defined as the cognitive evaluations of a specific target behavior along subjective dimensions such as like-dislike or positive-negative (Ajzen, 2001). There is extensive empirical evidence on this attitude-behavior relationship to suggest that positive attitudes indeed lead to behaviors. For example, much work testing and applying the TPB has been done in the field of health behaviors such as relationship between people's attitude towards condom use and their subsequent usage intentions. For this kind of behaviors, a number of meta-analyses of existing literatures indicate that the typical effect sizes as measured by weighted mean correlations range from 0.45 to 0.58 (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Sheeran & Taylor, 1999), implying a strong predictability of behavioral intention by attitude. Furthermore, experimental methodologies across domains have also shown converging evidence to suggest the causal relationship from attitude to behavior (e.g., Anderson et al., 1998; Carpenter & Reimers, 2005). However, direct evidence linking fertility attitude and actual childbearing is relatively scare in comparison. Nonetheless, few recent studies examining the validity of the TPB in predicting fertility behavior tended to support this claim by showing a strong relationship between fertility attitude and childbearing intention (Ajzen & Klobas, 2013; Klobas & Ajzen, 2015; Mencarini et al., 2015). For instance, applying structural equation model to the first wave of Gender and Generation Survey from eight European nations (Bulgaria, Russia, Georgia, Germany, France, Hungary, Italy, and Romania), Klobas and Ajzen (2015) found that fertility attitude, as defined as whether individuals had positive and favorable idea for having a child, indeed predicted the intention to have a child within these nations, albeit with some differences in effect sizes. In addition, using two waves of the Italian Gender and Generation Survey data, Mencarini et al. (2015) presented further validation of the TPB in fertility

decision-making by confirming that the higher level of positive fertility attitude, mediated through intentions, indeed resulted in higher likelihood of childbearing four years later in the follow up. Although definitive causal claim is not possible based on these correlational path analyses, they do confer confidence that exploration of fertility attitude is a promising avenue of research. For this reason, a specific focus was made on the fertility attitude to understand fertility behavior in this thesis.

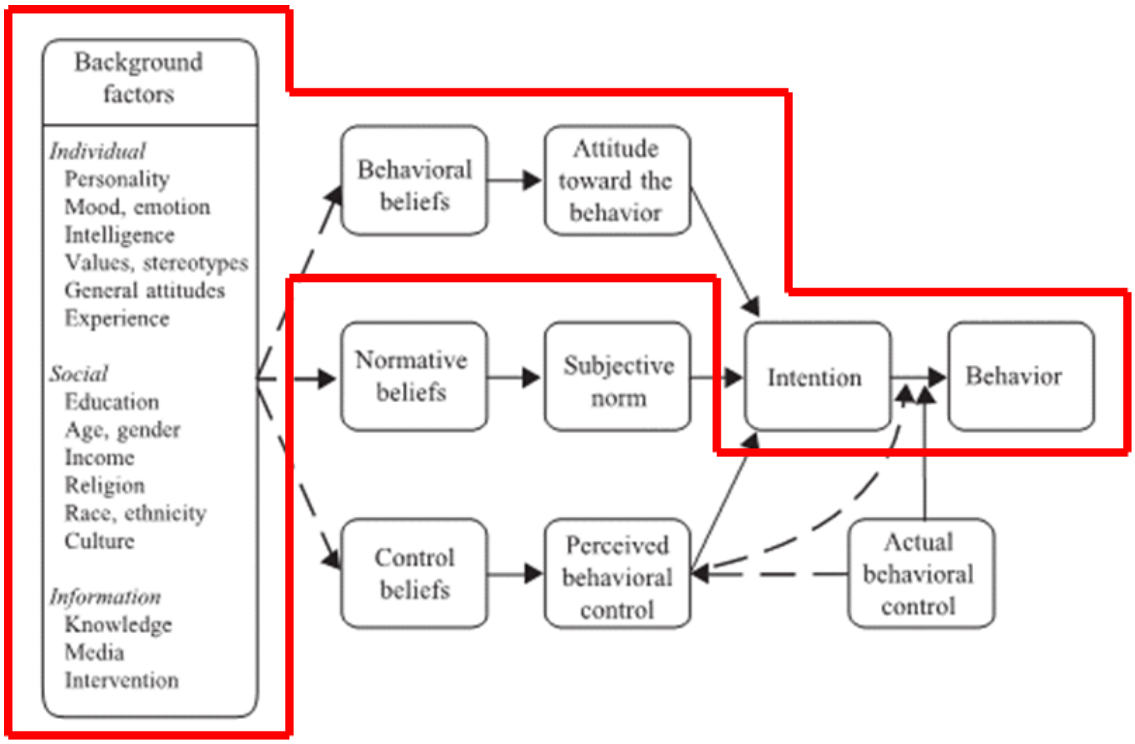


Figure 1. A diagram displaying the relationships among critical factors in the Theory of Planned Behavior with the highlighted enclosure representing key interests of this thesis.

Note: Adapted from "The influence of attitudes on behavior," by I. Ajzen and M. Fishbein, in D. Albarracin, B. T. Johnson, and M. P. Zanna (Eds.), *The Handbook of Attitudes* (p. 221), 2005.

To fully understand how and why attitude matters in promoting the fertility behaviors among couples, it is necessary to take a step further in the TPB. First of all, as was shown in the Figure 1, the attitude itself is actually a consequence formed by behavioral beliefs. More

precisely, according to Ajzen and Fishbein (2005), a behavioral belief is a combination of *perceived probability* of having an expected outcome from performing a given behavior (henceforth *probability belief*) and the person's *subjective evaluation of the outcome* itself (henceforth evaluation belief). As an example of evaluation belief, if the target behavior is to consume more fruits and vegetables, the evaluation of one expected outcome from the behavior might be attainment of healthier body, which could range from favorable to unfavorable. On the other hand, the probability belief would be a person's subjective judgment on how likely the person would be able to attain the healthier body through consumption of more fruits and vegetables. This may range from highly likely to highly unlikely. When combined, they form an attitude in which people show positive attitude if their probability belief is high and evaluation belief is favorable, for instance, with an array of attitude constructed from their combinations. Furthermore, a person may hold a number of behavioral beliefs associated with a target behavior, which Ajzen (1991) formally formulated to be summed up to construct an overall attitude towards the behavior.

$$\mathrm{A} \propto \sum_{i=1}^{n} p_i e_i \tag{1}$$

where *A* is attitude, *p* is perceived probability, and *e* is subjective evaluation.

From the Equation 1, it is obvious that an attitude is a weighted sum of expected outcomes of a behavior with weight being the perceived probability of attaining each outcome associated with the behavior. Applying this to the context of the fertility behavior (i.e., having an additional child), it would mean that people's attitudes towards having another child are formed in part by none other than the expected utility of having another child. More specifically, one survey evidence has indicated that there are total of 11 positive and negative areas of behavioral beliefs regarding the fertility behavior (Langdridge, Sheeran, & Connolly,

2005). As Table 1 shows, these lists are consistent with the idea that behavioral beliefs reflect potential utility (and disutility) associated with the fertility behavior. It is important to note that by no means these beliefs represent an exhaustive list of the behavioral beliefs associated with fertility behaviors as there may be differences across cultures and time periods (Ajzen & Klobas, 2013). Nonetheless, from the list, it can be concluded that fertility beliefs representing expected utilities constitute an important part of the fertility decision-making process.

Table 1

List of reasons for having or not having a child

Reasons for having a child	Reasons against having a child
- Would be fulfilling	- There are more important things in life
- Would please my partner	- Would restrict my freedom to do the things I enjoy
- Would make us a family	- My partner does not want a child
- Would be part of both of us	- Would interfere with my career
- Would give a child a good home	- Concern with over-population
- It's a biological drive	

Note: Adapted from "Understanding the reasons for parenthood," by D. Langdridge, P. Sheeran, and K. Connolly, 2005, *Journal of Reproductive and Infant Psychology*, *23*(2), p. 125.

As expected from the TPB, however, the behavioral beliefs (i.e., the evaluation and probability beliefs) themselves are formed by people's perceived knowledge about the subject in question. In other words, behavioral beliefs are generated through prior life experiences, second-hand information, and corresponding inferences, meaning that ultimately, the background factors (see Figure 1) are the most important antecedent factor of interest for

policy makers. With respect to the background factors, the TPB is flexible in that it does not specify characteristic factors in the theory but rather states that these elements should be determined case by case (Ajzen & Fishbein, 2005). To illustrate, continuing from the previous example, some background factors that may shape behavioral beliefs on consuming fruits and vegetables may be education and current health status. For instance, those with higher education may indeed believe that eating fruits and vegetable will be beneficial for their bodies (i.e., positive outcome evaluation). However, for people generally in good health, it may be unlikely to receive addition health benefit from consuming more fruits and vegetables, meaning that the probability is low for the target behavior to produce the desired outcome. Through such processes and through their combinations, each individual subjectively determines one's attitude towards consuming more fruits and vegetables, which could range from positive to negative. Therefore, in essence, the TPB proposes that behaviors are determined through multiple mediating processes but that the most causal antecedent lies in background factors such as sociodemographic and life experience factors.

1.5. Subjective Well-Being and its Relations to Fertility Outcomes

Naturally, depending on a specific target behavior, associated background factors will vary, and for this reason, finding influential factors for each behavior is largely an empirical exercise (Ajzen & Fishbein, 2005). However, considering that prior experiences with the behaviors and their subsequent consequences constitute background factors, the level of SWB may represent one critical factor that affects formations of behavioral beliefs and attitudes. This supposition logically stems from the conclusion reached in the previous section that SWB can influence people's perception of the difficulty or ease with which they can achieve expected outcomes from behaviors through its impact on people's sense of optimism and perseverance (Brand et al., 2010; Robinson & Hippel, 2006; Tremblay et al., 2006). In other

words, the level of SWB should positively contribute to the formation of probability belief aspect in the attitude. With respect to the fertility outcomes, sense of satisfaction in life seems to show robust relationships. So far, few researches conducted on this topic have shown that higher level of life satisfaction is related to better developmental outcomes and to less problematic behaviors among children (Berger & Spieß, 2011), which will likely result in less parenting stresses (Hoffman, Sweeney, Hodge, Lopez-Wagner, & Looney, 2009) and may eventually lead to positive behavioral beliefs and attitude towards childrearing and childbearing (Newman, 2008). Furthermore, in terms of future fertility outcomes, higher life satisfaction level led to greater likelihood of having a child in the future (Luhmann, Lucas, Eid, & Diener, 2013; Parr, 2010) especially for a second child (Le Moglie, Mencarini, & Rapallini, 2015; Perelli-Harris, 2006). Likewise, some indicative evidence pointed to the possibility that mothers with high resilience tend to pursue a second child (Perelli-Harris, 2006). All in all, it can be concluded that level of life satisfaction, through its impact on people's perseverance, acts as an important antecedent determining fertility attitude and outcomes (probability path).

Interestingly, SWB can also act as an evaluative part of fertility behavioral beliefs as well. More precisely, changes in the SWB across two time points may reflect a person's evaluation of the fertility outcomes. The reasons are as follows. As mentioned before, the life satisfaction measure lacks specificity with respect to evaluation of particular action, but since having a first child significantly changes a person's life context and is likely to be the most salient event during that period, the changes in the life satisfaction around the birth period would reflect the person's overall evaluation of the experiences associated with having the first child. Furthermore, it may be reasonable to expect the life satisfaction will decrease on average across period around having a first child due to biases in human cognitive process

known as affective forecasting. Specifically, researches on affective forecasting indicate that people are not necessarily accurate with predicting intensity and duration of emotions (Wilson & Gilbert, 2003). For example, when college football fans were asked to predict their level of happiness following the win of their team, the predicted level of happiness and duration were overestimated compared to the actual emotion expressed (their usual baseline happiness) when in fact their team did win (Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000). Moreover, this tendency may be further exacerbated by the contrast effect. Briefly, the contrast effect is a phenomenon in which people's emotional judgment of target stimulus is corrected away *in the opposite direction* from the expectation when the actual experience does not match the expectation. For instance, when judging movies expected to be funny and if in fact they were not, people would show even less enjoyment compared to when they had no expectation (Geers & Lassiter, 1999). The affective forecasting and the contrast effect create interesting SWB dynamics across parenthood period. Consider the finding that first time parents have a SWB peak around the time of pregnancy but tend to show drop in SWB soon after the birth (Myrskylä & Margolis, 2014). It is easy to imagine that first time pregnant mothers and expecting fathers may overestimate potential positivity from having their first child as could be expected from the affective forecasting. Hence, their actual life satisfaction after birth may become significantly less than the level during the pregnancy period. In addition, because large portion of parents cite childrearing to be much more difficult and stressful than what they have imagined before the birth especially for their first child (Newman, 2008), the resulting contrast effect may further contribute to the decline of life satisfaction following the birth, leading to the life satisfaction trajectory shown by Myrskylä and Margolis. Empirically, however, only one study investigated the impact of declined life satisfaction following birth of the first child on the subsequent likelihood of having a second child (Margolis & Myrskylä, 2015). Based on the lengthy longitudinal data

from German Socio-Economic Panel Study (GSOEP), Margolis and Myrskylä (2015) were able to generate the data set containing the amount of life satisfaction dropped across the first fertility period (defined as two years before the birth to one year after the birth). Their analysis of proportional hazard model indicated that those with more than 3-point drop in life satisfaction (out of 11-point scale) was predicted to result in 17% less likelihood of having a second child compared to those who did not experience the life satisfaction drop, indicating that parents who formed negative fertility evaluation belief (as represented by the life satisfaction drop) indeed showed greater preference not to have a second child. Thus, although changes in SWB may come about due to many factors, if the stated assumptions are reasonable, then the amount of drop in SWB should be a sufficient proxy of the evaluation belief associated with having another child (because it is an updated expectation).

In conclusion, arguments made above can be summarized by noting that general level of life satisfaction reflects perceived probability aspect of the fertility attitude and that the drop in life satisfaction across parenthood period indicates evaluative aspect of the fertility attitude.

1.6. Current Research and Hypotheses

Although processes outlined above implicate causal impact of life satisfactions, the empirical investigations supporting the theoretical rationales are far from causal in nature. To begin with, a number of researches indicated that the life satisfaction level is related to the fertility outcomes (Le Moglie et al., 2015; Parr, 2010; Perelli-Harris, 2006). In general, reverse causality is not an issue for these studies because they rely on longitudinal data to assess impact of life satisfaction at time *t* on fertility outcomes in subsequent years. However, it is highly likely that the life satisfaction level can be affected by omitted variables, which may affect the fertility outcomes simultaneously. For example, consider the subjective beliefs

regarding future economic outcomes. It may be that those who hold positive views on future prospects (whether it be due to national economic booms or be due to self-confidence in their own abilities) may be more likely to have higher life satisfaction than those who hold less positive views. At the same time, it is highly possible that people believe in positive future outlooks may be more willing to plan and to have another children now. Indeed, to address this kind of issues, Le Moglie et al. (2015) employed an instrumental variable (IV) analysis as a robustness check. Although, their chosen instrument (lagged weekly time spent on hobby) generally show weak relationship to the lagged life satisfaction[4], the Lewbel (2012) estimator they employed was considered to be an acceptable alternative. Overall, their IV results confirmed earlier analyses to indicate causality of life satisfaction level prior to pregnancy on subsequent second parity outcomes. Nonetheless, this is only one IV test of the relationship, and for generalizability of the results, it is warranted to pursue the matter with different dataset and with varying instruments. More importantly, the lagged life satisfaction level as used by Le Moglie et al. (2015) or others (e.g., Parr, 2010; Perelli-Harris, 2006) would not necessarily affect the formation of the fertility probability belief aspect and fertility attitude because of the temporal distances from the first fertility period. Qualitative evidence makes it clear that experience during the first fertility period (e.g., pregnancy and infant period) has paramount importance in determining further parity progression (Newman, 2008). As such, specific consideration of life satisfaction level across the first child period should entail qualitatively different consequences than those found in above mentioned studies, and arguably is more consistent from the theoretical perspective.

Likewise, the findings by Margolis and Myrskylä (2015) suffer from an endogeneity problem. As before, the reverse causality may not be an issue due to past changes in life satisfaction

[4] They lagged the life satisfaction variable to avoid pregnancy anticipation effect.

predicting future fertility outcomes, but there could still be omitted variables causing both changes in the life satisfaction across first fertility period and desire for another child. As a simple example, consider parents who have natural affinity towards children. It is easily conceivable that they may be less affected by parenting difficulties and their expectation regarding children may not degenerate as much as those who hold relatively less fondness for children. This would cause differences in the amount of life satisfaction declines with high affection group showing relatively less decline compared to low affection group. Similarly, those who have natural affinity for children may want to have more children for no other reason than simply liking children more than others. Hence, factors such as natural affinity for children may cause changes in both the life satisfaction decline and the probability for having another child, requiring an approach that corrects for such biases to derive strong causal inferences.

For the reasons stated above, the current study aimed to replicate the previous findings with the BHPS dataset and to extend them by demonstrating that the relationships discovered exist after potential biases have been corrected through IV process. Hypotheses were as follows: a) it was hypothesized that higher level of life satisfaction across first fertility period would be related to higher probability of having a second child; b) it was hypothesized that the drop in life satisfaction across first fertility period would be negatively related to the probability for having a second child; c) it was hypothesized that the positive relationship between the level of life satisfaction and probability of having a second child would persist even after correcting for potential biases; and d) it was hypothesized that the relationship between the drop in life satisfaction and the probability for second child would persist even after correcting for potential biases.

II. METHOD

2.1. Data

The data set used in this thesis is the British Household Panel Survey (BHPS) from the United Kingdom. The BHPS is a nationally representative panel survey that was conducted annually from 1991 to 2008 by the Institute for Economic and Social Research at the University of Essex. In the main panel, it initially included adults aged 16 and over from approximately 5500 Households and more than 10,000 individuals, but with new household members being added to the original sample members over the years as well as with the inclusion of panel extensions, it eventually led to the sample size of over 8,000 households and 14,000 individuals by the end of the panel (Brice, Buck, & Prentice-Lane, 2010).

For this thesis, one of the key reasons for choosing the BHPS data set was due to its well-documented respondent characteristics and a rich set of questions, which enabled discovery of potential instruments for the instrumental variable analysis. Furthermore, with relatively large number of respondents and sufficient accumulation of longitudinal data made the BHPS particularly suitable data set for the purposes of this thesis because, as will be explained in upcoming sections, the rather strict inclusion criteria of the current thesis meant that it required substantial sample size to maintain acceptable statistical stability and power after the data cleaning processes.

In terms of data selection, the data from wave 7 to 18 with an exception of wave 11 of the BHPS data set were used in this thesis. The wave 11 (year 2001) was not included because the life satisfaction question was not asked in that particular wave. Likewise, waves 1 through 5 were dropped as well because they also did not contain the life satisfaction question. As for the wave 6, although the life satisfaction data was available, because a key

variable of interest (frequency of meeting others [an instrument]) was only measured from wave 7 and forward, the wave 6 had to be dropped. In total, 11 waves of data were retained in the final data set.

2.2. Data Preparations

As a study extending Margolis and Myrskylä (2015) and investigating impact of first child experiences, fundamental data preparation procedures followed those from Margolis and Myrskylä. More specifically, the samples were restricted to those who never had a baby when individuals entered the panel in order to assess their life satisfaction (in addition to other covariates) at least one or two years prior to having their first baby (i.e., as a base line). In addition, those who did not end up having at least one baby during their participations in the panel were also dropped from the sample since the thesis was focused on whether experiences during parenthood transition (from first child) had any impact on the likelihood of having a second child. Finally, respondents who did not have values for control variables were also dropped out of the sample, leaving a total of 1348 individuals in the final sample.

The dependent variable in this study was a dummy variable indicating whether a person had a second child during the person's surveys in the panel (0 being no second child and 1 being had a second child). This was based on the British Household Panel Survey Consolidated Marital, Cohabitation and Fertility Histories data set generated from the original BHPS (Pronzato, 2010). It contains each respondent's fertility history in addition to birth year and month of the person's children. Based on this information, it was able to ascertain with relatively high certainty whether the person had a child before entering the panel and when they had their first and second (if any) children.

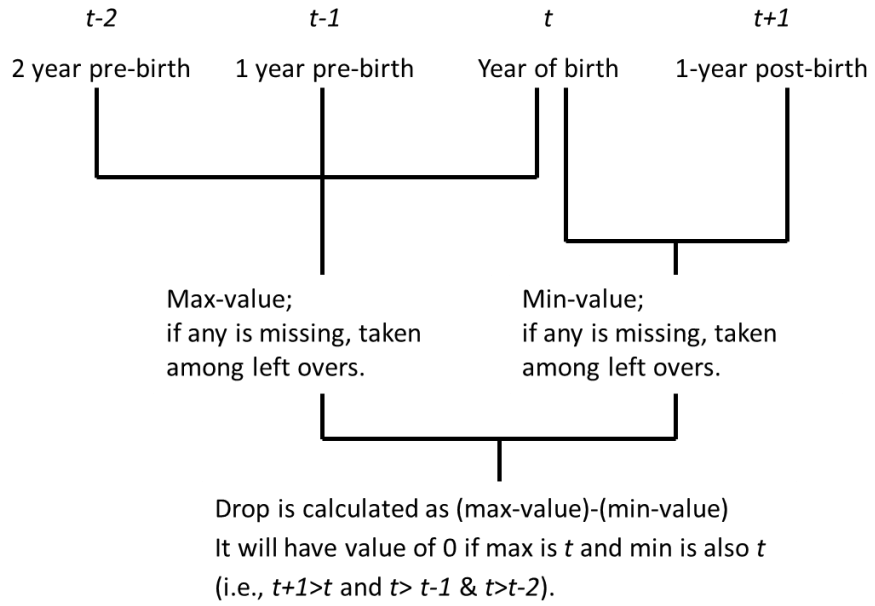
As for the key independent and control variables, a total of 15 variables were used in this thesis. First of all, the key variables pertaining to the hypotheses were derived from the basic measure of overall life satisfaction. In the BHPS, respondents were asked a question—"How dissatisfied or satisfied are you with your life overall?"—and their responses were measured in 7-point Likert scale with 1 being *Not satisfied at all* and 7 being *Completely satisfied*. From this, two derived life satisfaction variables were generated: a) average life satisfaction during the parenthood transition[5] and b) drop in life satisfaction during the parenthood transition[6]. Firstly, to generate the average life satisfaction during the parenthood transition, the life satisfaction values from two years before ($t\text{-}_2$), one year before ($t\text{-}_1$), at birth year (t), and one year after (t_{+1}) were averaged. In cases where values were missing, averaged value of remaining values was used in the derivation. Of note is that because the life satisfaction levels prior to having a child were important as baseline measures of life satisfaction (i.e., $t\text{-}_2$ and $t\text{-}_1$), samples were confined to those at least had the value for $t\text{-}_2$ or $t\text{-}_1$. For the generation of the drop in the life satisfaction variable, as can be seen in the Figure 2, a process adopted from Margolis and Myrskylä (2015) was taken[7]. Firstly, to generate the "drop," a maximum value was calculated among life satisfaction values from $t\text{-}_2$, $t\text{-}_1$, and t. Next, a minimum value was found by comparing values between t and t_{+1}. Then, the "drop" was derived by subtracting the minimum from the maximum. This resulted in the drop in life satisfaction variable to range from 0 (when maximum and minimum were both at t) to 6 with higher number representing relatively more negative assessment of the childbearing and childrearing experiences.

[5] Here the parenthood transition refers to the two years before, one year before, year at, and one year after the birth of first child, covering a 4-year span in total. In addition, the averaged life satisfaction refers to the probability aspect of fertility behavioral beliefs.

[6] The drop in life satisfaction refers to the evaluation belief part of fertility attitude.

[7] This is following the general definition used by Margolis and Myrskylä (2015). However, due to smaller sample size in the current thesis compared with the data set they have used, the definition was relaxed by not requiring all of $t\text{-}_2$ to t_{+1} values to generate the drop. For instance, if $t\text{-}_2$ was missing, the maximum value was considered between only existing values, which in this case would have been between $t\text{-}_1$ and t. Likewise, if t_{+1} was missing, then t was considered as the minimum value, and so forth. Although relaxing the definition was done to maintain adequate sample size, imposing the restriction did not change the overall pattern of the results.

Figure 2. Graphical Definition of Drop in Variables



Note: created by the author based on Margolis and Myrskylä (2015).

In addition to the life satisfaction variables, an important control variable that needed to be included was the household income during the parenthood transition. To start with, the household income was a derived variable summing annual total incomes of all individuals in the household. It was measured in pounds and covered a period of 12 months prior to the September 1st of each interview year. In this thesis, the household income was converted to real 1995 pounds by accounting for inflation changes and then was log transformed to correct for non-linear and right-skewed nature of household income. Furthermore, because some households contain more members than the nuclear family[8] (e.g., grandparents may live with their adult children), the household income was adjusted by dividing it with the square root of household size. Then, through the same processes as in the case of life satisfaction, the base measures for the household income variable was used to generate the average and the drop values. The rationale for their inclusions in the study was that the measured values of life satisfaction across the parenthood transition (e.g., the average and the drop) would be

[8] A household unit consisting of children and their parents.

positively related to the respective transitions in the household income. For instance, all things being equal, those who had higher average household income during the parenthood transition would be associated with higher average life satisfaction at that period because income has been shown to be a positive causal predictor of life satisfaction (Frijters, Haisken-DeNew, & Shields, 2004; Powdthavee, 2010). Furthermore, because households with higher income tend to experience positive life experience from the first child than lower income group (Pollmann-Schult, 2014), they would show less drop in life satisfaction across the parenthood transition period. Combined, they indicate that the household income in general (average and drop) would be related to the life satisfaction counter-parts during the transition period. Importantly, at the same time those who have more financial resources tend to show higher likelihood of having additional child (Lindo, 2010), meaning those with higher average household income or with less drop in the household income during the parenthood transition would be expected to have higher probability of having additional child in the future if one assumes those with higher income at one point in time would also be more likely to have relatively higher income in the future. As a whole, the household income affects both the life satisfaction and fertility probability, and therefore, is an important known confound for the relationship between the life satisfaction and second parity progression, which needed to be controlled.

In addition, a number of demographic variables were also included as controls. First, gender dummy (0 being male and 1 being female) was included to account for the fact that life satisfactions during the parenthood transition may vary by gender and that gender may have impact on desire for a second child ceteris paribus. Second, age at first birth (continuous variable) was also controlled because it is widely known that age is negatively related to life satisfaction especially around the typical age range for high fecundity (e.g., 18 to 44) due to

its U-shaped relationship (Blanchflower & Oswald, 2004; Ferrer-i-Carbonell & Gowdy, 2007) and because likelihood of having a child definitively decreases with increasing age due to biological reasons especially for women (Billari, Kohler, Andersson, & Lundström, 2007; Brodmann, Esping-Andersen, & Güell, 2007). For education achievement, a dummy variable (1 being more 12 years of education; 0 being 12 or less years of education) was generated from the International Standard Classification of Education. Here, respondent with less than post-secondary education was considered to have 12 or less years of education while those with any post-secondary education was defined to have more than 12 years of education. Level of education was included to control for potential covariation with life satisfaction and with probability of progressing to second parity. This is because those with higher education have been reported to opt for more children (Margolis & Myrskylä, 2015; Mills, Mencarini, Tanturri, & Begall, 2008) as well as to show higher life satisfaction during the parenthood transition (Myrskylä & Margolis, 2014).

Furthermore, marital status was also controlled through two dummies variables (categorically defined as 0 being not married, 1 being cohabitation, and 2 being married). The reason was clear in this case. First, large segment of first birth (nearly 30% of all births) in United Kingdom occur under the cohabitation, and those who are married than cohabitating show more stable relationships over time (Crawford, Goodman, & Greaves, 2013). This naturally means that individuals who have a stable partner (i.e., married) have better childbearing outcomes than those who are single or are in cohabitation relationship (Baizán, Aassve, & Billari, 2002; Spéder & Kapitány, 2009). Thus, extending the logic, those who had stable relationship during the first child period may have a stronger foundation for progressing towards having a second child than those who did not. As for its relationship with the life satisfaction during parenthood transition period, the life satisfaction of married individuals

tends to be higher than those cohabiting or singles (Angeles, 2010; Stutzer & Frey, 2006), and these general relationships are also expected to be consistent for the life satisfaction across the parenthood transition period (Kohler, Behrman, & Skytthe, 2005). Thus, as a covariate related to both the life satisfaction variables and the outcome variable, it was essential to control for the marital status.

Moreover, job status dummy (0 being not working and 1 being working) was required as a control. Extant literatures on employment status and the SWB indicate that being unemployed lowers life satisfaction substantially (Dolan et al., 2008). As for its relationship with the fertility behavior, as expected, being unemployed is related with less probability of having a(nother) child (Adsera, 2011; Spéder & Kapitány, 2009).

Another necessary control was type of access to childcare. In the BHPS, it was asked in every wave whether respondents with young children have childcare arrangement while they are at work. There were number of possible responses ranging from friends and relatives to daily nursery. In addition, each respondent answered up to 3 arrangements they used. Here, the responses were coded into three variables such that the first dummy variable had value of 1 if respondents mentioned friend and relative in any of 3 arrangements they stated and 0 if otherwise. Next, the second dummy variable had value of 1 if respondents said spouse (partner) or nanny (mother) in any of the arrangements and 0 if otherwise. Finally, the third dummy had value of 1 if they mentioned any other childcare types and 0 if otherwise. As the variable was applicable for working parents, having these three variables in the model would result in the reference group being not working parents who takes care of children themselves. As may be expected, having a childcare arrangement may increase the likelihood of having a

second child, and it may influence life satisfaction at the same time potentially due to reduced burden. Hence it was included as a control variable[9].

Next, not as critical but included nonetheless were region dummy variables representing areas in which respondents were living (i.e., to control for idiosyncratic effects of living in particular region) and whether the household had an adult other than parents living. More specifically, the latter was controlled through a dummy variable (0 being only parents and 1 being someone other than parents) as having non-parent adults at home could potentially provide informal childcares, resulting in covariations with the life satisfaction and the fertility behavior variables. In addition, a dummy variable indicating whether respondents were saving any income (0 being not saving and 1 being saving) because understandably, those who saved income may have higher life satisfaction as it shows tendency to take long-term perspective (e.g., Ifcher & Zarghamee, 2011) and because those who saved may be more likely to be planning for another child. Moreover, housing status was controlled with a dummy variable (0 being rented and 1 being owned) because owning a house may simultaneous affect both life satisfaction and probability of having a second child in the future. Finally, the number of waves that each individual was observed in the panel after having the first child was also controlled because individuals who had child earlier in the panel were more likely to have the second child during their stay in the panel simply due to having longer observation period. Table 2 summarizes variables used in the thesis with short descriptions.

Of particular note is that education achievement, marital status, job status, childcare accesses, having non-parents at home, saving status, housing status, and region living were values at

[9] It will be elaborated in the instrumental variable section, but briefly, the variable was also included to control for potential impact that frequency of meeting variable (instrument) may have on second parity progression.

(t_{+1}). The choice was more or less arbitrary in that they were relatively stable across the parenthood transition period and changing measurement time to (t_{-2}), (t_{-1}), and (t) did not change the pattern of overall results (see robustness check section).

Table 2

Brief summaries of dependent, independent, and control variables used

Variable	Description	Purpose
Life Satisfaction-Averaged	Averaged life satisfaction across first birth period	To explore effect of person's general level of life satisfaction on second parity
Life Satisfaction-Drop	Life satisfaction drop following the first birth	To explore effect of drop in person's life satisfaction on second parity
Age	Age of respondent at first birth	To control for person's age at the time as older people are less likely to have another child and may have systematic differences in life satisfaction at the time.
Sex	Sex of respondent	To control for sex differences in outcome of second parity and life satisfaction
Education	Education level achieved by respondent in dummy	To control for education level as highly educated people may be less likely to conceive second child and have implications on life satisfaction
Marriage Status	Legal marital status one year after the birth	To control for marital status as unmarried or single parents at the time could have both impact on second parity and life satisfaction
Job Status	Job status one year after the birth	To control for impact of job status on second parity which could also affect life satisfaction
Number of panel observations	Number of observations from the wave at which respondents had first child until the wave they exited	To control right censoring; those who had first child later have less observations, resulting in less likelihood of observing second parity than otherwise.

Childcare arrangement	Childcare arrangement one year after the birth	To control for effects that having access to different types of childcares may have on second parity.
Saving status	Saved any income at one year after the birth	To control for effects of saving behavior may have on life satisfaction and on second parity.
Housing status	Whether owned or rented house	To control for effects of owning house on life satisfaction and on second parity.
Household Income (log)-Averaged Household Income (log)-Drop	Averaged CPI-adjusted log household income Drop in CPI-adjusted log household income	To control for effects of household income (average and drop) on the life satisfaction (average and drop) and on second parity.
Someone at household	Non-parent adult present in household dummy	To control for impact of informal childcare on life satisfaction variables and second parity.
Region Lived	Area lived one year after the birth	To control for potential regional heterogeneity

2.3. Instrumental variables

As discussed, one of the short-comings of previous studies such as Margolis and Myrskylä (2015), and Parr (2010) was the endogeneity problem caused by omitted variables. For this reason, simple ordinary least squared estimations cannot find the unbiased estimate of the impacts that the life satisfaction variables have on the future fertility behavior. As such, to establish causal impacts of life satisfaction variables on the likelihood of further progressing to second child, it was necessary to properly account for the biases. To this end, instrumental variable approach was adopted in this study.

Instrumental variables (IV) analysis is a method that estimates causal impacts of endogenous independent variables through use of instruments which establish exogenous variations (Wooldridge, 2009). In order to be qualified as an instrument, two critical assumptions have

to be met. First, the instruments need to be high correlated with the endogenous variables or more formally, $Cov(z_i, x_i) \neq 0$ (*criteria 1*). In essence, this means that the instrument must be relevant to the endogenous variable, and this is important because instruments with weak correlations can result in even larger biases than in simple OLS estimations (Wooldridge, 2009). Secondly, the instruments must not be correlated with the error term as in $Cov(z_i, u_i) = 0$ (*criteria 2*). This emphasizes the fact that the instruments themselves must be exogenous; otherwise, the estimated effects will be inconsistent (Wooldridge, 2009). Once variables satisfactorily meet these two conditions, they can then be used as instruments to correct biases in estimation of endogenous variables.

Based upon these criteria, three instruments were identified in this thesis. The first instrument for the life satisfaction variables was frequency of meeting people. In the BHPS, a question was asked "How often do you meet friends or relatives who are not living with you? Is it ..." with responses ranging from 1 being *On most days* to 5 being *Never*. This was reversed coded in this thesis so that 5 being *On most days* and vice versa. To keep the consistency with the life satisfaction variables, respective derivations of the frequency of meeting people variable were created using the same processes from the average and the drop life satisfaction variables. As for the rationale, the idea was that those who had more socialization during the periods of anticipation, pregnancy, childbearing, and first year of childrearing would have received more social support, resulting in generally higher level of life satisfaction than those who made relatively less contacts (Bruni & Stanca, 2008; Klein, 2013; Lelkes, 2006). Therefore, variations in social contact during the period should covary positively with the life satisfaction variables (e.g., satisfying the *criteria 1*). In contrast, it is unlikely that frequency of meeting people would have direct and systematic impact on people's decisions to have another child despite some literatures claiming social network

effect on fertility decision (e.g., Lois & Becker, 2014). This is because it is difficult to imagine that those who meet more people will only meet those who have more than one children, which is required condition to produce the desired social learning effect. Even then, it is unlikely that this particular situation would lead *systematically* to positive (or negative) social learning experience for prospective family. For instance, one study showed that the number of children in one's social network did not have any impact on intention to have a second child (Billari, Philipov, & Testa, 2009), indicating that any social learning impact from having higher frequency of meeting friends or relatives should not translate into higher probability of having a second child. Arguably, it may still be possible that those who meet more friends or relatives have access to more childcare helps from them, which may result in positive fertility outcomes in the future. However, having controlled for the potential childcare supports from relatives and friends, any direct impact that the frequency of meeting friends or relatives may have on childcare benefits should not, in turn, be affecting the second parity progression. Thus, the frequency of meeting variable was not expected to influence the fertility outcome in the present case (satisfying the *criteria 2*). In sum, it is assumed here that frequency of meeting people variables (the average and the drop) satisfies the two criteria and qualify as an instrument for the life satisfaction variables (the average and the drop).

The second instrument utilized was about perceived inequality and unfairness in society. The question probed whether respondents were in agreement with the statement " There is one law for the rich and one for the poor." Possible answers ranged from *strongly agree* (1) to *strongly disagree* (5), which was reverse coded to reflect stronger agreement with increasing values. Because the variable was measured only some of the waves (1, 3, 5, 7, 10, 14, and 17), any measured value during the first fertility period was used as indicator of respondents' perceived fairness of society at the period. Note that this assumed the opinion was constant

during the first fertility period but considering that it covered relatively short 4-year period, it should not have varied widely. As for the first criteria, it was expected that perceived fairness variable would be positively related to average and negatively to the drop life satisfaction variables, respectively. A body of evidence shows that sense of corruption is negatively related to subjective well-being (Rodríguez-Pose & Maslauskaite, 2012; Tay, Herian, & Diener, 2014). If perceived corruption and societal fairness is viewed as equivalent to each other, this implies that the fairness variable should be associated with life satisfaction variables. Conversely, for the second criteria, having the view that society is not fair to poor should not affect one's decision to have a second child. Possibly that a person's level of income may affect one's view on this matter, but having controlled for income, the sense of fairness in society is not expected to have direct impact on the person's decision to have another child. Therefore, the fairness variable was considered as an adequate instrument meeting the two criteria.

Finally, the third instrument for the life satisfaction variable was whether respondents liked their present neighborhood. The question asked "Overall, do you like living in this neighbourhood?" with the answer being a binary response (*yes* or *no*). Here two types of derivations were used for each of average and drop life satisfaction variables were also applied. Hence, for the average life satisfaction, the neighborhood variable across the first fertility period was averaged, meaning that the more times respondents answered *yes*, the more they were expected to positively related to average life satisfaction (ranging from 0 to 1). On the other hand, for the drop life satisfaction, the drop neighborhood variable essentially represented whether respondent came to dislike neighborhood at post-birth period (either 0 or 1 with 1 being came to dislike). Hence, the drop life satisfaction and drop neighborhood were also positively correlated. As for the rationale, it is clear that those who

like their neighborhood should be more satisfied with their life as a whole. However, having a second child being a significant life decision, it should not depend on whether respondents like the neighborhood itself at the time of first fertility period since it would be unlikely that couples consider having their second child soon after having the first one. For these reasons, it was assumed that the neighborhood variable was acceptable instrument for the life satisfaction variables.

2.4 Empirical methodologies and Specifications

2.4.1. Linear Probability Model:

To examine the relationship between the life satisfaction and the fertility outcomes, linear probability model (LPM) was implemented, which is an approach used when dependent variable has a binary response. For the purposes of the current thesis, the LPM method had several advantages over non-linear modelling such as logistic regression or probit modelling. The most significant being that the estimated coefficients of variables are in marginal forms, making them easier to interpret in contrast to the aforementioned non-linear modellings (Hellevik, 2009). In addition, although it has one downside in which predicted probability is unbounded, meaning it may be outside of 0 to 1 range, because the key interest in this thesis is on the marginal effects rather than predicted probability, this should not pose significant threats to the final results. The basic LPM model describing the impact of life satisfaction changes on subsequent second parity progression is as follows:

$$\begin{aligned} Sec_i = \beta_0 + \beta_1 LS_i + \beta_2 Age_i + \beta_3 Sex_i + \beta_4 Educ_i + \beta_5 Single_i + \beta_6 Married_i \\ + \beta_7 Job_i + \beta_8 Panel_i + \beta_9 Chilcare1_i + \beta_{10} Childcare2_i \\ + \beta_{11} Childcare3_i + \beta_{12} Inc_i + \beta_{13} Save_i + \beta_{14} Tenure_i \\ + \beta_{15} Someone_i + \boldsymbol{Regiony} + \varepsilon_i \end{aligned}$$

The *Sec* is a dummy dependent variable with value of 1 indicating a person had a second child while surveyed in the panel and 0 indicating otherwise. The *LS* is a continuous key independent variable measuring life satisfaction level. As mentioned, there were two key *LS* variables (the *average* and the *drop*). For the *average LS* variables, a higher value indicates higher level of life satisfaction through the course of parenthood transition. As for the *drop LS* variable, a higher value suggests greater decline in the life satisfaction during the period. The two *LS* variables were standardized to make interpretation and comparison easier. Likewise, the *Inc* was a continuous control variable that had the two variations and standardization as in the life satisfaction variables. It measures the *averaged* and the *drop* adjusted household income level during the transition period. The *Age* was a continuous control variable indicating the age at the birth of first child. The *Sex* was a gender dummy control variable with value of 0 assigned to male and 1 to female. The *Educ* was an education dummy control variable with value of 0 indicating education level less than or equal to 12 years and 1 for more than 12 years. The *Single* was a marital status dummy control variable with value of 0 for those who were cohabiting and 1 for those who were single. The *Married* was another marital status dummy control with value of 0 being those who cohabit and 1 being those who were married at the time. The *Job* was a job status dummy control variable with value of 0 being not employed or not in labor market and 1 being currently employed. The *Panel* was a continuous control variable which indicated number of observations in the panel after the first birth. The *Childcare1, Childcare2,* and *Childcare3* were childcare status dummy variables with 0 being access to no childcare and 1 being friend or relative, spouse or nanny, and any other services, respectively. The *Save* was a dummy variable with 0 noting not save any income and 1 noting does save some income. The *Tenure* was a housing status dummy with 0 indicating rented household and 1 indicating

owned. The *Someone* was a dummy control variable with 0 indicating a nuclear family and 1 indicating non-parent adult present in the household. The ***Region*** was a collection of dummy control variables representing the place of residence at 1-year after the birth of a first child. Finally, ε was an error term.

2.4.2. Instrumental Variables

The model for the first-stage is as follows:

$$\begin{aligned} LS_i = \delta_0 + \delta_1 Meet_i + \delta_2 Fairness_i + \delta_3 Neighborhood_i + \delta_4 Age_i + \delta_5 Sex_i \\ + \delta_6 Educ_i + \delta_7 Single_i + \delta_8 Married_i + \delta_9 Job_i + \delta_{10} Panel_i \\ + \delta_{11} Chilcare1_i + \delta_{12} Childcare2_i + \delta_{13} Childcare3_i + \delta_{14} Inc_i \\ + \delta_{15} Save_i + \delta_{16} Tenure_i + \delta_{17} Someone_i + \boldsymbol{Regiony} + r_i \end{aligned}$$

Here, *Meet* was one of the instruments used which measured frequency of meeting friends and others. It was continuous variable and was also matched to the form of *LS* variable being predicted (i.e., the *averaged* and the *drop*). *Fairness* was another instrument that measured respondents' perceived unfairness in society. It was also continuously measured with higher value indicating greater perceived unfairness in society. Finally, *Neighborhood* was a dummy instrument that indicated whether respondents liked their presented neighborhood (0 being do not like and 1 being like the neighborhood). This was also matched to the form of *LS* variable. Rest of the variables were the same as in the OLS specification expect r_i representing the error term in the first stage. The model for the second-stage is as follows:

$$Sec_i = \beta_0 + \beta_1^{IV}\widehat{LS}_i + \beta_2 Age_i + \beta_3 Sex_i + \beta_4 Educ_i + \beta_5 Single_i + \beta_6 Married_i$$
$$+ \beta_7 Job_i + \beta_8 Panel_i + \beta_9 Chilcare1_i + \beta_{10} Childcare2_i$$
$$+ \beta_{11} Childcare3_i + \beta_{12} Inc_i + \beta_{13} Save_i + \beta_{14} Tenure_i$$
$$+ \beta_{15} Someone_i + \boldsymbol{Regiony} + \varepsilon_i$$

The specification is the same as in the OLS estimations except that the life satisfaction variables were replaced by the predicted life satisfaction variables from the first stage.

III. RESULTS

3.1. Descriptive Statistics

Summary of descriptive statistics are presented in Table 3. Starting with the dependent variable, the sample included 55% of parents who had a second child during their participation during the panel. As for the key independent variables, the average life satisfaction showed somewhat higher values for those with second child than those without. Likewise, the drop in life satisfaction also exhibited lower drop for those who had second child compared with those who did not. Overall, the life satisfaction variables through the transition period seemed to indicate there were differences between the two groups.

Brief examinations of values indicated that age at first birth, saving status, housing status, average meeting frequency, neighborhood variables, and perceived unfairness showed little difference between those who had a second child and those who did not. Conversely, compared to the one child group, in the group with a second child, there were relatively less female, more educated parents, less single parents, less cohabitations, more married parents, less employed parents (presumably mothers), more non-parent adults residing at home, less household income (the averaged and the drop), and finally, less drop in the frequency of

meeting others. Overall, the descriptive statistics show there are quantitative differences across number of variables including the critical key variables (i.e., life satisfaction) between those who only had one child and those who had two.

Table 3

Summary of descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Having a Second Child[a]	1348	0.546	0.498	0	1
Having a Second Child[b]	612	0.000	0.000	0	0
Having a Second Child[c]	736	1.000	0.000	1	1
Life Satisfaction Average[a]	1348	0.008	0.982	-4.834	1.732
Life Satisfaction Average[b]	612	-0.085	1.049	-4.469	1.732
Life Satisfaction Average[c]	736	0.085	0.916	-4.834	1.732
Life Satisfaction Drop[a]	1348	0.041	1.002	-0.787	5.519
Life Satisfaction Drop[b]	612	0.142	1.046	-0.787	5.519
Life Satisfaction Drop[c]	736	-0.043	0.956	-0.787	4.468
Age[a]	1348	28.869	6.072	16	55
Age[b]	612	29.011	6.683	16	55
Age[c]	736	28.750	5.514	17	55
Sex[a]	1348	0.542	0.498	0	1
Sex[b]	612	0.557	0.497	0	1
Sex[c]	736	0.530	0.499	0	1
Education[a]	1348	0.422	0.494	0	1
Education[b]	612	0.369	0.483	0	1
Education[c]	736	0.466	0.499	0	1
Single Parents[a]	1348	0.094	0.292	0	1
Single Parents[b]	612	0.149	0.356	0	1
Single Parents[c]	736	0.049	0.216	0	1
Cohabitation[a]	1348	0.286	0.452	0	1
Cohabitation[b]	612	0.340	0.474	0	1
Cohabitation[c]	736	0.240	0.428	0	1
Married[a]	1348	0.620	0.486	0	1
Married[b]	612	0.511	0.500	0	1
Married[c]	736	0.711	0.454	0	1
Employed[a]	1348	0.731	0.444	0	1
Employed[b]	612	0.752	0.432	0	1
Employed[c]	736	0.713	0.453	0	1
Panel Observations[a]	1348	5.815	2.846	2	11
Panel Observations[b]	612	4.508	2.651	2	11
Panel Observations[c]	736	6.902	2.528	2	11

Childcare Access 1[a]	1348	0.203	0.403	0	1
Childcare Access 1[b]	612	0.217	0.413	0	1
Childcare Access 1[c]	736	0.192	0.394	0	1
Childcare Access 2[a]	1348	0.065	0.247	0	1
Childcare Access 2[b]	612	0.064	0.244	0	1
Childcare Access 2[c]	736	0.067	0.249	0	1
Childcare Access 3[a]	1348	0.096	0.294	0	1
Childcare Access 3[b]	612	0.090	0.286	0	1
Childcare Access 3[c]	736	0.101	0.301	0	1
Saving Status[a]	1348	0.412	0.492	0	1
Saving Status[b]	612	0.412	0.493	0	1
Saving Status[c]	736	0.412	0.492	0	1
Housing Status[a]	1348	0.745	0.436	0	1
Housing Status[b]	612	0.721	0.449	0	1
Housing Status[c]	736	0.765	0.424	0	1
Someone[a]	1348	0.195	0.396	0	1
Someone[b]	612	0.172	0.377	0	1
Someone[c]	736	0.215	0.411	0	1
Household Income (log) Average[a]	1348	0.039	1.003	-4.381	2.782
Household Income (log) Average[b]	612	0.294	1.019	-4.223	2.782
Household Income (log) Average[c]	736	-0.174	0.939	-4.381	1.930
Household Income (log) Drop[a]	1348	-0.111	0.930	-1.538	5.806
Household Income (log) Drop[b]	612	-0.220	0.914	-0.951	5.806
Household Income (log) Drop[c]	736	-0.020	0.934	-1.538	5.292
Meet Average[a]	1348	4.371	0.522	2.333	5.000
Meet Average[b]	612	4.368	0.540	2.500	5.000
Meet Average[c]	736	4.373	0.506	2.333	5.000
Meet Drop[a]	1348	0.507	0.641	0	4
Meet Drop[b]	612	0.539	0.662	0	4
Meet Drop[c]	736	0.480	0.621	0	3
Like Neighborhood Average[a]	1348	0.920	0.183	0	1
Like Neighborhood Average[b]	612	0.918	0.182	0	1
Like Neighborhood Average[c]	736	0.921	0.184	0	1
Like Neighborhood Drop[a]	1348	0.103	0.304	0	1
Like Neighborhood Drop[b]	612	0.106	0.308	0	1
Like Neighborhood Drop[c]	736	0.101	0.301	0	1
Perceived Unfairness[a]	1348	3.457	0.947	1	5
Perceived Unfairness[b]	612	3.444	0.922	1	5
Perceived Unfairness[c]	736	3.467	0.968	1	5

Note. Variables with *a* represent the total, with *b* include only those without second child, and with *c* include only those with second child; Household Income, Life Satisfaction variables are standardized.

3.2. Replications of Previous Studies

To start with, replications of prior studies were conducted because of the different samples, variable specifications, and analyses methodologies used in the main analyses of the current study. More specifically, the results from Le Moglie et al. (2015) and Margolis and Myrskylä (2015) were replicated. In contrast to the main analyses of current thesis, both studies utilized German Socioeconomic Panel dataset. In addition, Le Moglie et al. used panel probit methodology[10] with 1-year lagged life satisfaction variable to predict subsequent likelihood of having a second child. As for Margolis and Myrskylä, they used Cox proportional hazard model with drop in life satisfaction variable specification to predict its impact on probability of having a second child. Note that since the key variable of interest was life satisfaction variable, not all of the control variables used in above studies were included in the replication. First, the replicated results of Le Moglie et al. are presented in Table A-1 (see Appendix A). The general pattern of results was similar to those from Le Moglie et al. in that the lagged life satisfaction indeed positively predicted the likelihood of having a second child next survey year among those who had one child. Even in terms of coefficient, the results were quite similar as Le Moglie et al. reported 0.041 for women to 0.048 for men while the coefficient found in the current thesis was about 0.060 for both genders, suggesting that similar patterns of findings in both studies. The results of replication for Margolis and Myrskylä were also as expected. As can be seen in Table A-2 (see Appendix A), 2-point drop (about equivalent to 3-point drop in 11-point scale[11]) in life satisfaction was associated with about 17% less proportional hazard of having a second child, which was consistent with the finding from Margolis and Myrskylä showing about 17% decrease in proportional hazard from more than 3-point drop from 11-point scale. Therefore, the previous findings were conceptually

[10] It was not clearly specified whether they used random effect or population-averaged; hence random effect was used here.

[11] Calculated as 7:11 = x:3 in which x is about 1.9

replicated in the current thesis with different dataset, adding confidence to the validities of general approach and sample employed in the thesis.

3.3. OLS Analyses of the Relationship Between Life Satisfaction and Second Parity

Here in the main analyses, OLS estimations were conducted to establish the relationships between the life satisfaction variables and probability of having a second child. Note that specific differences in coefficients were not discussed as they were generally consistent and the key interest was on the life satisfaction variables.

Firstly, as shown in the Table 4, the two life satisfaction variables showed statistically significant relationships with the probability of having a second child. In the case of the model exploring the average life satisfaction during the parenthood transition period, the estimated result indicated that one standard deviation increase in the average life satisfaction (*SD* = 0.897 in the 7-point scale) would be associated with 4.1% higher overall probability of having a second child while holding all control variables constant, supporting the first hypothesis predicting the positive relationship between the two variables. Conceptually, this finding is consistent with the previously reported results in which various specifications of the life satisfaction level had positive impacts on subsequent fertility outcomes (Le Moglie, et al., 2015; Parr, 2010; Perelli-Harris, 2006). More precisely, Le Moglie et al. (2015) estimated that for men, 3-point increase in the life satisfaction, for instance, would result in 5% higher overall probability of having a second child in the subsequent year. The effect they found was less remarkable for women in which it was predicted to raise the probability by about 2.6% overall. Converting the marginal effect from the current thesis to equivalent scale produced about 8.7%[12], which was somewhat larger in comparison.

[12] 7:11 = x:3 which give x = 1.9; in addition, 0.897:1.9 = 0.041:y which gives y=0.087

Table 4

OLS estimations of the impacts life satisfaction variables have on the probability of having a second child

	OLS	
	(1)	(2)
Age at first birth	-0.013***	-0.012***
	[0.003]	[0.003]
Sex	-0.127**	-0.128**
(Ref: Male)	[0.047]	[0.047]
Education	0.097***	0.102***
(Ref: 12 or less)	[0.029]	[0.029]
Single Parent	-0.196***	-0.199***
(Ref: Cohabitation)	[0.048]	[0.047]
Married	0.191***	0.184***
(Ref: Cohabitation)	[0.037]	[0.037]
Employed	-0.168***	-0.161***
(Ref: Not Employed)	[0.042]	[0.042]
Panel Observations	0.076***	0.073***
	[0.005]	[0.007]
Childcare Access 1	0.063	0.058
	[0.049]	[0.049]
Childcare Access 2	0.134*	0.133*
	[0.062]	[0.061]
Childcare Access 3	0.109+	0.107+
	[0.056]	[0.056]
Someone	0.072*	0.068+
(Ref: No)	[0.036]	[0.037]
Saving Status	-0.023	-0.018
	[0.027]	[0.027]
Housing Status	-0.035	-0.038
	[0.037]	[0.039]
Household Income	-0.019	-
(log) Drop	[0.025]	-
Household Income	-	-0.014
(log) Averaged	-	[0.023]
Life Satisfaction	-0.031*	-
Drop	[0.013]	-
Life Satisfaction	-	0.041**
Averaged	-	[0.013]
Constant	0.740***	0.835**
	[0.166]	[0.280]
Region Dummy	Yes	Yes
N	1348	1348
R^2	0.258	0.259

Note: Robust standard errors clustered on household ID was used for both analyses; standard errors in brackets; + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Adjusted Household Income, Life Satisfaction variables were standardized.

Perhaps the discrepancy could be attributable to the differences in the specification of life satisfaction. For instance, it may be that the average life satisfaction during the period of first child may be more relevant in further childbearing decisions arguably because it relates more directly to how parenting experience would be affected (i.e., through its effect on perseverance). Conversely, the life satisfaction one year prior would be temporally too distant from the initial experience to affect childbearing attitude as significantly. In addition, the current finding was also consistent with Parr (2010) and Perelli-Harris (2006) who both showed positive influence of the life satisfaction level on the birth outcomes (2- and 7-year follow-ups, respectively), which predicted fertility outcome further down the line. However, the life satisfaction level measured in their studies were also non-specific in that they were not temporary related to any specific event such as first child period. As such, their findings and the current findings differ on the life context in which the current thesis focused on the first child period. Therefore, in one sense, the findings in thesis provide converging evidence of the importance that life satisfaction have on probability of having a second child. On the other hand, the noble contribution of the current study was the discovery that maintaining generally higher level of life satisfaction across the first fertility period could be critically important for subsequent fertility behavior.

As for the second hypothesis concerning the relationship between the drop in life satisfaction across the first fertility period and the likelihood of having a second child, the results from the second model showed that the drop in life satisfaction negatively predicted the probability for a second child. More specifically, the estimated coefficient indicated that the drop during the period in the magnitude of one standard deviation (SD = 0.788) can decrease the overall probability by 3.1%. This result is in direct support of the findings by Margolis and Myrskylä (2015). Few comparisons can be made here. First, while Margolis and Myrskylä

used the data from German panel data, the data used here were from the United Kingdom. The fact that similar results were derived from two sets of data provides evidence for generalizability of the findings. In addition, the estimated marginal effects were comparable between two studies. Margolis and Myrskylä indicated that those who had 3-point or more drop in the life satisfaction was 10% less likely to have a second child than those who experienced no drop in terms of estimated probability. In the current study, the equivalent value of drop[13] would result in 7.5% less likelihood of having a second child, which is in the same direction with slightly smaller effect. As a whole, the drop in life satisfaction during the parenthood transition seems to be a useful predictor of future fertility behavior. The finding, thus, indirectly indicated that changes in the evaluation beliefs associated with childbearing and childrearing (as represented by the drop in life satisfaction) may shape subsequent fertility behaviors, implicating the potential importance of creating good initial experiences.

Comparing the coefficients of the two life satisfaction variables, it could be seen that the average life satisfaction showed larger marginal effect than the drop variables[14]. However, a formal statistical test of the difference in coefficients revealed that the 1% difference was not statistically significant, indicating that it was not a meaningful difference to consider. In contrast, as shown in Table 5, when considering the two variables in the same equation, the average life satisfaction remained statistically significant, albeit with smaller coefficient, while the drop life satisfaction turned marginally significant, suggesting that although both variables seemed to explain somewhat unique aspects of second parity outcomes, the average life satisfaction was more dominant. Without a direct test it is speculative but this may

[13] 7:11 = x:3 which give x = 1.9; in addition, 0.788:1.9 = 0.031:y which gives y=0.075
[14] Direct comparison could be made because they were standardized variables.

indicate that probability beliefs may be relatively more important than evaluation beliefs in determining second parity progression.

Table 5

Comparisons of Coefficients between the Two Life Satisfaction Variables

	Life Satisfaction Variable Comparisons		
	Wald Test	Average Life Sat.	Drop Life Sat.
The averaged vs. the drop (1)	$\chi^2 = 0.43$; p=0.514		
Coefficients when put in the same equations (2)		β=0.034; p=0.01	β=-0.023; p=0.09

Note: Robust standard errors clustered on household ID was used for the regression (2); Regression (2) used the same specification as in the model 2 in Table 4 except that the drop in life satisfaction variable was added; Life Satisfaction variables were standardized.

For the control variables, the age at birth of first child showed strongly significant negative relationship with the probability. This meant that getting one year older around the time of first birth would result in 1.2% decline in the probability of having a second child[15]. Despite the differences in the magnitude, this finding in general was as reported across many countries (e.g., Brodmann et al., 2007; Le Moglie et al., 2015; Perelli-Harris, 2006), indicating that the age at first birth as a control behaved as expected and importantly that postponement of first birth is likely to negatively impact the second childbearing.

As for the gender variable, it was also consistently associated with having a second child. For instance, across model 1 and 2 showed about 12.8% decline in the probability for women compared to men. This is in-line with Margolis and Myrskylä (2015) although the findings in the current study were slightly weaker than their findings. One potential reason behind this

[15] This is based on the model 2.

observation could be due to the fact that childbearing for majority of individuals takes strong commitment especially for women. Hence, they may be more reluctant to enter second parity. In the case of education, the relationship was significantly positive such that those who had more than 12-years of education at the time of first fertility showed 10.2% higher likelihood of having a second child than those who have 12-years or less education at the time. This confirmed the findings from previous studies (Le Moglie et al., 2015; Margolis & Myrskylä, 2015; Mills et al., 2008). In brief, one possible explanation for this result could be the catch-up effect. It has been suggested by number of natural experiment studies that pursuit of higher education typically results in postponement of first child, but has not led to decline of the quantity of children that highly education parents end up having (Geruso, Clark, & Royer, 2011; Monstad, Propper, & Salvanes, 2008). Bearing in mind that the observation period in the panel data was far from that of completed fertility period (i.e., right censored), it may be that highly educated mothers take shorter interval between each childbearing perhaps due to their postponement in the first fertility period (i.e., older age). Therefore, the observed education effect could be driven by the desire to catch up among highly educated people; however, without further investigation, this inference remains speculative.

Partnership status was also as expected from previous literatures (e.g., Baizán et al., 2004; Spéder & Kapitány, 2009). The OLS estimates indicated that compared with those who were cohabiting with a partner, parents who were single during at 1-year post first birth showed 19.9% lower likelihood of having a second child in the future. In contrast, if parents were married at the time (i.e., had a more stable partner), they were 18.4% more likely than cohabiting parents to have a second child. At the face value, these findings suggest that having stable marriage at the first fertility period may have lasting impact on the probability for the second child. Indeed, prior study indicated that development outcomes for children of

cohabiting couple at the first parity period tended to be worse than married (Crawford et al., 2013), potentially creating more stress for parents and decreasing desire for more children and that cohabiting couples were more likely to separate than married in the future (Crawford et al., 2013), which would conceivably have some impact on further parity progression. Additionally, employment was found to be an important predictor of having a second child as well. If parents were employed 1-year post birth, their probability of having a second child was lowered by 16.1%. Consistently, despite the smaller coefficient, the direction of result in the current study was as reported by Margolis and Myrskylä, suggesting potential inhibitory influences of competing responsibilities and opportunity costs associated with holding a job.

In the case of panel observation variable, the result was as expected in that longer observation following the first birth period was associated with higher probability of having a second child, which indicates that there might exist right censoring bias without the inclusion of the variable. As for the childcare variables, the results revealed that compared to caring for children on their own, having helps from relatives or friends for child caring did not influence second parity outcomes. However, it showed that if respondents had access to mothers (nanny) or spouse (husband) as child care provider, they were 13.3% more likely to have a second child in the future than those who did not have any other access. Finally, parents with access to any other childcare providers such as day nursery were only marginally better than those had no access at all. Overall, the results tended to support the conception that having a childcare access during the first parity period helps in advancing to second parity.

Likewise, consistent with the expectation, the results showed that having non-parent adults in household were generally related to parity progression in which about 6.8% increase in the probability of having a second child was predicted if parents had lived with non-adults during

the transition period. This suggests that perhaps having a helping hand in the household could further reduce the burden of having child in addition to having the childcare access, contributing to couple's decision to have more children.

Somewhat unexpectedly, those who saved some income or who owned a house at 1-year post birth of child did not seem to have higher probability of having a second child. Another interesting finds from the control variables were that the adjusted household income variables had no significant impact on the probability. This was consistently the case across the average and the drop in household income variables. For instance, the amount of average household income across the first fertility period was not significantly associated with the probability of having a second child. Perhaps this is the case because life satisfaction variable itself was included in the specification. For example, Pollmann-Schult (2014) suggested that those with higher income tended to derive more life satisfaction from having a child, which could in turn affect further fertility likelihood. For this reason, once life satisfaction has been accounted for, the household income at the time of first birth itself may not necessarily have the expected effect on the probability of having a second child. This was also the case in Perelli-Harris (2006); hence, the current study provides some support for their findings. Likewise, the amount of drop in adjusted household income at the first fertility period showed no significant correlation to the second fertility probability presumably because of the same reasoning as outlined above. Overall, the findings in the current study indicated that having controlled for satisfaction with life, income related variables such as saving, housing and actual household income during the first fertility period had little impact on future fertility behavior.

3.4 Instrumental Variables Analyses

The specifications and the estimated coefficients for the control variables in the IV analyses were essentially the same as those from the simple OLS estimations. Hence, the reports and discussions of control variables were not revisited here, but rather, the focus was placed on the life satisfaction variables instead.

To start with, the first-stage for IV_1 (model 3) was examined, which estimated the combined impact of instruments (i.e., excluded exogenous variables) over and above the controls (i.e., included exogenous variables) on the drop in life satisfaction variable. As shown in the Table 6, it revealed that when examined independently, the drop in neighborhood variable was not statistically significant whereas the drop in frequency of meeting and the perceived unfairness in society were both positively related to the drop in life satisfaction as expected. Because of this, the three instruments were only jointly significant at the F-value of 6.28 which was less than the 10 used commonly as a rule of thumb (Staiger & Stock, 1997)[16]. This meant that the instruments especially the neighborhood variable was only weakly relevant to the drop in life satisfaction variable. Examining the coefficients themselves suggested that correlations were as expected from previous studies (e.g., Bruni & Stanca, 2008; Klein, 2013; Rodríguez-Pose & Maslauskaite, 2012; Tay et al., 2014) in which the frequency of meeting (drop) and perceived unfairness were positively related to the life satisfaction (drop). Furthermore, although the relationship between the drop in likeness of neighborhood variable and the drop in life satisfaction was not statistically significant, the direction was as expected in that if respondent came to dislike the neighborhood at any point during the first fertility period, they had higher the drop in life satisfaction. As for the over-identification test, the result was not

[16] Removing the neighborhood instrument did not improve F-value much; as such, all three instruments were retained for the consistency sake.

significant at all, indicating that the three instruments were all exogenous to the extent that if at least one was assumed to be an exogenous instrument.

In terms of the second stage of IV_1 (model 4), the finding regarding the drop in life satisfaction variable was statistically weaker than it was in the OLS case; only partially supporting the third hypothesis at best. Although the *p*-value (0.071) was only marginally significant, the drop in life satisfaction across the parenthood transition period was negatively related to the probability of having a second child, indicating that at least the direction of effect was consistent with the OLS finding. More specifically, the estimated coefficient indicated that one standard deviation increase in the life satisfaction drop (*SD* = 0.788) causes 23.1% decline in the probability of having a second child. This was noticeably greater than the OLS estimate from the model 2 (3.1%) and larger than the 10% marginal effect reported by Margolis and Myrskylä (2015). Firstly, compared to the OLS estimate, the coefficient from the IV analysis was about 7.5 times larger. Interestingly, the standard error was about 9.8 times larger, suggesting that marginal significance was largely due to markedly increased standard error. According to Wooldridge (2009), because there are less variations in the predicted endogenous variable (from the first stage), it is always the case that the IV analysis will produce higher standard error than the OLS approach. Furthermore, exacerbating the problem was the relatively weak instruments used here, which raised the standard error as well. Hence, the statistically weak finding may be due to generally inefficient nature of IV analysis. Regarding the size of coefficient itself, it also seems to be somewhat overestimated in that one standard deviation in the drop can affect the probability of having a second more than the effect of being married compared to being cohabiting, which only raised the likelihood by 18%. More appropriate conclusion then may be to take the OLS coefficient as underestimation and treat it as the lower bound and take the IV coefficient as the potential

upper bound of the effect caused by life satisfaction drop. Therefore, to the extent that the effect is causal with the size reported in the model 2, it certainly implicates the need for greater attention paid to improve the experiences during the first fertility period such as better provision of childcare assistance.

Moving on to the first-stage for IV_2 (model 5), the results were somewhat more consistent with the expectation. The frequency of meeting (average) was still statistically significant and positively predictive of the life satisfaction (average) as before in the model 3. Likewise, the perceived unfairness variable was statistically and negatively related to the average life satisfaction as expected, and in contrast to the model 3, the neighborhood instrument was strongly and positively related to the average life satisfaction. As a whole, the three instruments were strong predictor of the average life satisfaction independently and also in linear combination (F-value greater than 16), suggesting that they were strongly relevant instruments. Moreover, in line with the model 3, the over-identification test was still non-significant in the model 5 with $p = 0.901$. In sum, the available test of instruments showed ideal results, conferring strong confidence that the instruments were valid.

Turning to the second-stage of IV_2 analysis concerning the average life satisfaction (model 6), the result was also somewhat different from the simple OLS results. Firstly, the average life satisfaction in IV_2 analysis was positively and significantly related to the probability of having a second child, supporting the fourth hypothesis. More specifically, compared to the case in the OLS analysis, the coefficient in IV_2 analysis was about 3.2 times larger while at the same time the standard error was 2.8 times bigger. This meant that at least the increases were largely consistent with each other. Moreover, it indicated that the OLS coefficient of 4.1% might have been underestimated due to potential omitted variables and attenuation bias

inherent in life satisfaction measures (e.g., Powdthavee, 2009). Considering that the relevancy and over-identification tests were both satisfactory, causal impact of average level of life satisfaction across the first fertility period on probability of having a second child may be claimed. Thus, it is likely that one standard deviation (*SD* = 0.897) increase in the average life satisfaction across the period would raise the probability of having a second child by 13% overall. Additionally, the strong causal impact in turn implies that positive probability beliefs may affect fertility attitude through its positive influence over the perseverance in parenting[17]. Overall, it can be concluded that raising the level of parents' life satisfaction during the first child period will increase the likelihood of having a second child.

Table 6

Instrumental variables analyses on the probability of having a second child

	$2SLS_1$		$2SLS_2$	
	1st (3)	2nd (4)	1st (5)	2nd (6)
Perceived Unfairness	0.085**	-	-0.093**	-
	[0.029]	-	[0.029]	-
Meet Drop	0.095*	-	-	-
	[0.043]	-	-	-
Meet Average	-	-	0.208***	-
	-	-	[0.062]	-
Like Neighborhood Drop	0.181	-	-	-
	[0.111]	-	-	-
Like Neighborhood Average	-	-	0.915***	-
	-	-	[0.182]	-
Age	-0.005	-0.014***	-0.008	-0.011***
	[0.006]	[0.003]	[0.006]	[0.003]
Sex	-0.042	-0.140*	-0.069	-0.125**
	[0.129]	[0.055]	[0.117]	[0.047]
Education	-0.005	0.093**	-0.038	0.106***
	[0.061]	[0.031]	[0.058]	[0.029]
Single Parent	0.392**	-0.122+	-0.318**	-0.171***
	[0.129]	[0.074]	[0.120]	[0.051]
Married	-0.032	0.182***	0.210**	0.163***
	[0.071]	[0.039]	[0.065]	[0.040]

[17] A simple test of relationship between sense of optimism and life satisfaction was conducted in the robustness check section.

Employed	-0.202+	-0.209***	-0.008	-0.163***
	[0.108]	[0.053]	[0.100]	[0.042]
Panel Observation	-0.020+	0.072***	-0.001	0.074***
	[0.011]	[0.006]	[0.015]	[0.007]
Childcare Access 1	0.044	0.072	0.183	0.04
	[0.137]	[0.056]	[0.121]	[0.050]
Childcare Access 2	0.022	0.140*	0.083	0.124*
	[0.147]	[0.069]	[0.145]	[0.062]
Childcare Access 3	0.003	0.112+	0.203	0.091
	[0.151]	[0.061]	[0.128]	[0.057]
Someone	0.003	0.078*	0.101	0.06
	[0.078]	[0.039]	[0.074]	[0.037]
Saving Status	-0.132*	-0.052	0.054	-0.025
	[0.054]	[0.035]	[0.051]	[0.028]
Housing Status	-0.079	-0.06	0.221**	-0.067
	[0.086]	[0.042]	[0.082]	[0.043]
Household Income (log)	0.115+	0.007	-	-
Drop	[0.060]	[0.031]	-	-
Household Income (log)	-	-	0.094+	-0.026
Averaged	-	-	[0.052]	[0.023]
Life Satisfaction	-	-0.231+	-	-
Drop	-	[0.128]	-	-
Life Satisfaction	-	-	-	0.133*
Averaged	-	-	-	[0.064]
Constant	0.074	0.835***	-2.098**	0.926***
	[0.325]	[0.178]	[0.720]	[0.280]
Hansen test (J-statistics)	-	1.052 [0.5910]		0.208 [0.9012]
Kleibergen-Paap F-statistics	-	6.280 [0.0003]		16.327 [0.0001]
Observations	1348	1348	1348	1348
Region Dummy	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered on household ID was used for all analyses; standard errors in brackets; significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$; Adjusted Household Income, Life Satisfaction variables were standardized.

3.5. Robustness Checks

To ascertain that the observed relationships are consistent across different specifications, a number of robustness checks were conducted.

3.5.1. Timing of Control variables

As mentioned, in the main analyses, the timing of selected control variables (marital status, employment status, saving status, housing status, education level, childcare accesses, having non-adult in household, and region resided) was set at 1-year post birth of first child. Here, the same analyses were conducted with variations in the time of above variables ranging from two years before the birth of first child to the year at the birth of first child. Note that childcare access variables before the birth of first child were not applicable and hence were dropped from the models pertaining to two and one year before the first birth. Overall, different specifications led to slight changes in the size of coefficients and significance levels of life satisfaction variables. More specifically, as shown in Table 7, in general the net life satisfactions were shown to be consistently significant albeit varying degrees of statistical significance. In terms of coefficients and statistical significance, the drop in life satisfactions variable was changed relatively more radically, suggesting that they were affected by timing of control variables to some extent. Conversely, the average life satisfaction variable was more consistent across specification although it became somewhat less significant statistically. Regardless, the patterns of results were largely consistent with the main analyses, and thus, they did not change the overall conclusion.

Table 7

Instrumental Variable Analyses Results with Ranges of Control Variables

	Year of the Birth (*t*)		Year of the Birth (*t-1*)		Year of the Birth (*t-2*)	
	(1)	(2)	(3)	(4)	(5)	(6)
Age	-0.013***	-0.010***	-0.015***	-0.012***	-0.014***	-0.012***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Sex	-0.015	-0.018	-0.055**	-0.062***	-0.063**	-0.080***
	[0.040]	[0.038]	[0.018]	[0.018]	[0.021]	[0.020]
Education	0.097***	0.107***	0.072**	0.087**	0.088**	0.104***
	[0.027]	[0.026]	[0.027]	[0.027]	[0.030]	[0.029]

Single Parent	-0.117+	-0.114*	-0.090*	-0.063	0.001	0.001
	[0.061]	[0.055]	[0.043]	[0.045]	[0.051]	[0.046]
Married	0.146***	0.133***	0.096**	0.096**	0.056	0.059+
	[0.033]	[0.034]	[0.034]	[0.034]	[0.036]	[0.035]
Employed	-0.027	-0.023	-0.06	-0.038	-0.064	-0.061
	[0.033]	[0.031]	[0.040]	[0.031]	[0.053]	[0.045]
Panel Observation	0.083***	0.080***	0.083***	0.078***	0.086***	0.080***
	[0.004]	[0.006]	[0.004]	[0.006]	[0.005]	[0.006]
Childcare Access 1	-0.016	-0.031	-	-	-	-
	[0.041]	[0.040]	-	-	-	-
Childcare Access 2	-0.023	-0.019	-	-	-	-
	[0.059]	[0.056]	-	-	-	-
Childcare Access 3	-0.096*	-0.098*	-	-	-	-
	[0.043]	[0.041]	-	-	-	-
Someone	-0.065	-0.066	-0.074*	-0.081*	-0.109**	-0.115**
	[0.090]	[0.090]	[0.035]	[0.035]	[0.040]	[0.039]
Saving Status	-0.036	-0.031	0.011	0.013	0.021	0.007
	[0.025]	[0.024]	[0.026]	[0.026]	[0.028]	[0.029]
Housing Status	-0.034	-0.027	-0.01	-0.005	-0.013	-0.023
	[0.046]	[0.038]	[0.034]	[0.034]	[0.036]	[0.035]
Household Income (log)	0.002	-	0.001	-	-0.003	-
Drop	[0.031]	-	[0.029]	-	[0.034]	-
Household Income (log)	-	-0.02	-	-0.033	-	-0.025
Averaged	-	[0.021]	-	[0.022]	-	[0.025]
Life Satisfaction	-0.144	-	-0.122	-	-0.167	-
Drop	[0.126]	-	[0.113]	-	[0.145]	-
Life Satisfaction	-	0.105+	-	0.099+	-	0.142*
Averaged	-	[0.056]	-	[0.056]	-	[0.068]
Constant	0.582**	0.687**	0.604***	0.856***	0.633***	0.849**
	[0.181]	[0.266]	[0.146]	[0.249]	[0.163]	[0.300]
Hansen test (J-statistics)	0.312 [0.8557]	0.070 [0.9658]	0.209 [0.9008]	0.785 [0.6753]	0.642 [0.7253]	1.139 [0.5658]
Kleibergen-Paap F-statistics	4.646 [0.0031]	17.665 [0.0000]	5.543 [0.0009]	18.034 [0.0000]	3.45 [0.0161]	13.090 [0.0000]
Observations	1527	1527	1509	1509	1280	1280
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets; Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$; Household Income, Life Satisfaction variables are standardized.

3.5.2. Controlling for Personality

Although the IV analyses should not be affected by personality factors when properly conducted, there could still be influence of personality characteristics on the relationships between the life satisfaction and further fertility in the future. The BHPS dataset offer the Big-Five personality measures[18], but because they were only measured once in the panel (wave 15), some respondents were dropped out of sample, resulting in smaller sample size than the main analyses. In addition, because the personality inventory was only measured once, it was assumed that the personality characteristics did not change over time (e.g., Le Moglie et al., 2015). Hence, rather than employing changed personality, the level of personality at particular point in time was used as stable personal characteristics. Although some attenuations in the size of coefficients were apparent, as can be seen in Table 8, the overall patterns of the OLS and the IV findings were essentially the same when the personality variables were included, indicating that the observed relationships between life satisfaction and the probability of having a second child was independent of individual idiosyncratic characteristics. Although exact impacts of personality characteristics on fertility outcomes differed from the prior literature, the findings in the current study essentially replicated the fact that personality factors do not affect the relationships between life satisfaction variables and probability of having a second child (Le Moglie et al., 2015). Therefore, more confidence can be placed on the claim that the higher parity fertility behaviors are not determined entirely by the fixed characteristics of a person but rather are governed through cognitive processes, which are shaped by first child experiences.

[18] They are consisting of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.

Table 8

Analyses exploring the relationship between life satisfaction, personality, and likelihood of having a second child

	OLS		IV	
	(1)	(2)	(3)	(4)
Openness	-0.009	-0.01	-0.005	-0.01
	[0.014]	[0.014]	[0.016]	[0.014]
Conscientiousness	0.012	0.008	-0.004	-0.01
	[0.015]	[0.015]	[0.021]	[0.020]
Extraversion	-0.021+	-0.024+	-0.026+	-0.032*
	[0.013]	[0.013]	[0.014]	[0.014]
Agreeableness	0.019	0.014	0.034	0.008
	[0.019]	[0.019]	[0.023]	[0.019]
Neuroticism	-0.005	-0.006	-0.008	-0.004
	[0.019]	[0.019]	[0.021]	[0.019]
Age	-0.012***	-0.012***	-0.013***	-0.011***
	[0.003]	[0.003]	[0.003]	[0.003]
Sex	-0.108*	-0.114*	-0.112*	-0.120*
	[0.051]	[0.051]	[0.057]	[0.052]
Education	0.114***	0.118***	0.107**	0.125***
	[0.031]	[0.031]	[0.033]	[0.031]
Single Parent	-0.175***	-0.176***	-0.124+	-0.154**
	[0.052]	[0.052]	[0.072]	[0.055]
Married	0.196***	0.189***	0.187***	0.164***
	[0.041]	[0.041]	[0.042]	[0.045]
Employed	-0.153***	-0.147**	-0.193***	-0.153***
	[0.046]	[0.045]	[0.058]	[0.045]
Panel Observation	0.072***	0.070***	0.069***	0.071***
	[0.006]	[0.009]	[0.007]	[0.009]
Childcare Access 1	0.037	0.039	0.042	0.033
	[0.053]	[0.053]	[0.058]	[0.053]
Childcare Access 2	0.113+	0.116+	0.119+	0.118+
	[0.064]	[0.064]	[0.070]	[0.064]
Childcare Access 3	0.08	0.084	0.084	0.078
	[0.059]	[0.060]	[0.063]	[0.060]
Someone	0.094*	0.089*	0.094*	0.078+
	[0.040]	[0.040]	[0.042]	[0.041]
Saving Status	-0.036	-0.032	-0.057	-0.035
	[0.029]	[0.029]	[0.035]	[0.030]
Housing Status	-0.026	-0.031	-0.045	-0.062
	[0.040]	[0.043]	[0.044]	[0.048]
Household Income (log)	-0.023	-	0.002	-
Drop	[0.027]	-	[0.035]	-

Household Income (log)	-	-0.01	-	-0.019
Averaged	-	[0.031]	-	[0.030]
Life Satisfaction	-0.028*	-	-0.207	-
Drop	[0.014]	-	[0.140]	-
Life Satisfaction	-	0.038*	-	0.136+
Averaged	-	[0.015]	-	[0.075]
Constant	0.714**	0.838*	0.805***	1.066**
	[0.224]	[0.383]	[0.244]	[0.409]
Hansen test (J-statistics)	-	-	1.242 [0.5374]	0.402 [0.8180]
Kleibergen-Paap F-statistics	-	-	5.137 [0.0016]	12.650 [0.0000]
Observations	1200	1200	1200	1200
Region Dummy	Yes	Yes	Yes	Yes

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets; Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$; Household Income, Life Satisfaction variables are standardized.

3.5.3. IV-Probit Analyses

Although it was argued in the previous section that the LPM approach should be adequate in most circumstances, an alternative approach was tested. More specifically, the IV-Probit estimation methodology is used when the dependent variable is binary and the model contains continuous endogenous explanatory variables. Thus, it was appropriate for the current purpose. As displayed in Table 9, the findings generally showed the same pattern of results. The most critical differences arose in the drop in life satisfaction case, which turned statistically significant, because the IV-Probit approach tends to be more efficient than the IV-LPM counterpart. Furthermore, the estimated marginal effects of life satisfaction variables from the IV-Probit approach tended to be more modest than those found from the IV-LPM. In general, however, they showed consistent results as in the main analyses, further strengthening the conclusion that life satisfaction variables have considerable causal influences on the likelihood of having a second child.

Table 9

Marginal effects from the predicted results of IV-Probit estimations

	(1)	(2)
Age at first birth	-0.012***	-0.012***
	[0.003]	[0.003]
Sex	-0.116*	-0.120**
(Ref: Male)	[0.048]	[0.046]
Education	0.074*	0.099***
(Ref: 12 or less)	[0.031]	[0.028]
Single Parent	-0.097	-0.157**
(Ref: Cohabitation)	[0.076]	[0.050]
Married	0.141**	0.150***
(Ref: Cohabitation)	[0.047]	[0.041]
Employed	-0.174***	-0.158***
(Ref: Not Employed)	[0.042]	[0.041]
Panel Observations	0.054***	0.065***
	[0.014]	[0.007]
Childcare Access 1	0.061	0.037
	[0.047]	[0.049]
Childcare Access 2	0.125*	0.130*
	[0.061]	[0.061]
Childcare Access 3	0.092+	0.084
	[0.053]	[0.055]
Someone	0.066+	0.061+
(Ref: No)	[0.034]	[0.036]
Saving Status	-0.043+	-0.025
	[0.024]	[0.026]
Housing Status	-0.039	-0.051
	[0.031]	[0.039]
Household Income	0.011	-
(log) Drop	[0.025]	-
Household Income	-	-0.023
(log) Average	-	[0.021]
Life Satisfaction	-0.192**	-
Drop	[0.066]	-
Life Satisfaction	-	0.127*
Average	-	[0.052]
Region Dummy	Yes	Yes
Observations	1348	1348

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets; Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$; Household Income, Life Satisfaction variables are standardized.

3.5.4. Relationship between Life Satisfaction and Tendency for Positive Outlook

As part of the theoretical rationale, it was explicitly assumed that through its influences over people's sense of perseverance, the level of life satisfaction would have positive impact on the probability beliefs regarding fertility behaviors and eventually on fertility outcomes. Here, using recent data from the first wave of the *Understanding Society: The UK Household Longitudinal Study,* parts of the assumed relationships were tested. Although they were rather simple OLS estimations, the findings were in line with the expected directions, providing preliminary supports for the concept (see Table 10). In detail, the fertility intention was a binary variable (0 being no; 1 being yes) measured by a question that asked "Do you think you will have any more/any children?" Here, pregnant respondents or those with pregnant partners were dropped of sample. Sense of optimism on the other hand was a continuous variable ranging from 1 (*none of the time*) to 5 (*all of the time*), which asked "Here are some statements about feelings and thoughts. Please select the answer that best describes your experience of each over the last 2 weeks. I've been feeling optimistic about the future." The higher the value, the more optimistic a respondent was. Another key variable of interest was the outcome probability aspect of the behavioral beliefs. Because fertility outcome probability was not measured in the survey, specific test with regards to the fertility context was not possible. However, the survey did contain a question measuring probability belief aspect of environmental behavioral beliefs. Specifically, it asked "Please tick whether, on the whole, you personally believe or do not believe each of the following statements: Climate change is beyond control - it's too late to do anything about it." As a binary variable, possible answers were either "*Yes, I believe this*" (code as 0) or "N*o, I do not believe this*" (coded as 1). As can be seen from the question, when respondent answered "*Yes,*" it meant that they did not believe positive outcome was probable while "*No*" meant that they believed positive outcome was still possible. Thus, the question reflected respondents' orientations on

positive outcome probability, albeit about environmental behaviors. Considering then the assumed positive effects of life satisfaction on perseverance and in turn on beliefs regarding positive outcome probability should not be limited to fertility (or environmental) behaviors, this question was judged to be a sufficient proxy to demonstrate these relationships. In other words, it was assumed that the signs and significance of the relationships would be the same with the fertility outcome probability beliefs. In addition, a key control variable regarding general risk preference was also included to limit omitted variables biases. For instance, people with high risk tolerance may be more willing to take chance at having children even when their circumstance do not warrant them. At the same time, they may also show more optimism than otherwise. Hence, it was included as a key control variable. Regarding the variable itself, in the survey, respondents were asked "Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?" They could answer from *Avoid risk taking* (0) to *Fully prepared to take risk* (10) with higher value being greater preference for risks.

For rest of the variables, as per usual, the *age* was a continuous variable in years, the *sex* was a dummy variable (0 being *male*; 1 being *female*), the *marital status* was a categorical variable (0 being *single*; 1 being *out of marriage*; 2 being *married*), the *employment status* was a dummy variable (0 being *no*; 1 being *yes*), the *number of children* was continuous variable reflecting number of own biological children, the *personal income* was log transformed income of each individual, and finally, the *life satisfaction* variable was 7-point scale measure as used in previous analyses.

In terms of actual results, discussions of control variables were out of scope for the purposes of robustness analyses. Hence, only the results of key variables were presented here. Firstly,

the findings of interests were that level of life satisfaction had positive impact on people's intention to have more children in the future (model 1) even when the sample was restricted to those who currently have one child (model 7). Although coefficients suggested that 1-point increase in the life satisfaction would only be associated with 0.8 to 2.0 percentage point higher likelihood of having intention for more children, the direction of relationship was as expected from the theoretical rationale stated in previous sections, eliciting confidence in further analyses of relationships. Next, it was rationalized that higher life satisfaction should lead to higher optimism among people, helping people to persevere through hardship. Here, the result supported the assumption in that 1-point higher life satisfaction was related to 0.210 (model 2) to 0.212 (model 8) higher value of optimism (in 5-point scale), which was robust even to those who already had one child. Finally, for the case of life satisfaction, 1-point higher life satisfaction was associated with 0.8 (model 9) to 1.6 (model 3) percentage point higher likelihood of believing that the climate change is still within control, confirming the postulate that high life satisfaction should be associated with stronger belief in positive outcome probability.

For the case of optimism, the level of optimism was positively associated with the intention to have more children with the marginal effects ranging from 1.8 (model 4) to 3.0 (model 10) percentage points, supporting the notion that high sense of optimism should be related to having positive fertility attitudes and eventually intentions. Additionally, consistent with the expectation, the level of optimism was significantly related to the environmental beliefs such that 1-point higher optimism score was associated with 2.2 to 2.5 percentage point higher chance of believing that climate change was still possible, meaning optimism is indeed related to the probability aspect of behavioral beliefs.

Finally, it was imaginable that if the climate change probability belief was a proxy of the fertility probability belief, then it should be positively related to the intention for more children because the climate change belief to some extent reflects the person's general tendency to have strong beliefs in high likelihood of positive outcomes. As shown in model 6 and 7, those who believed that climate change was still possible also had 1.2 and 4.2 percentage point higher probability of intending for more children, respectively. Hence, it appears that having general tendency to believe in occurrence of positive outcomes may be beneficial for fertility intentions as well.

However, it is critical to note that the direction of causality could not be determined in these analyses in addition to potential biases arising from omitted variables. In addition, these tests were only one of many potential mechanisms through which level of life satisfaction may affect fertility intentions. Despite these limitations, however, the findings, at the least, presented preliminary picture of the paths from life satisfaction to fertility intentions.

Table 10

OLS regression analyses examining relationships among fertility intention, sense of optimism, positive beliefs, and life satisfaction using full sample

Dependent Var.	Intention (1)	Optimistic (2)	Env.Belief (3)	Intention (4)	Env.Belief (5)	Intention (6)
Age	-0.025***	-0.004***	0.002***	-0.025***	0.002***	-0.025***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Sex	-0.062***	0.069***	0.037***	-0.063***	0.036***	-0.062***
	[0.005]	[0.013]	[0.006]	[0.005]	[0.006]	[0.005]
Out of Marriage	-0.051***	0.033	-0.013	-0.052***	-0.015	-0.052***
(Ref: Single)	[0.009]	[0.024]	[0.011]	[0.009]	[0.011]	[0.009]
Married	0.018*	0.076***	0.022**	0.018*	0.024**	0.020**
(Ref: Single)	[0.008]	[0.017]	[0.008]	[0.008]	[0.008]	[0.008]
Employed	-0.011+	0.044**	0.035***	-0.011+	0.038***	-0.009
(Ref: Not)	[0.006]	[0.015]	[0.007]	[0.006]	[0.007]	[0.006]

Number of Children	-0.124*** [0.003]	-0.024*** [0.006]	0.001 [0.003]	-0.124*** [0.003]	0.001 [0.003]	-0.125*** [0.003]
Personal Income	0.006*** [0.001]	-0.008* [0.004]	-0.004* [0.002]	0.006*** [0.001]	-0.004* [0.002]	0.006*** [0.001]
Risk Taking Preference	0.002** [0.001]	0.044*** [0.003]	0.002* [0.001]	0.002* [0.001]	0.002 [0.001]	0.003** [0.001]
Life Satisfaction	0.008*** [0.002]	0.210*** [0.005]	0.016*** [0.002]	- -	- -	- -
Optimistic	- -	- -	- -	0.018*** [0.002]	0.025*** [0.003]	- -
Environmental Belief	- -	- -	- -	- -	- -	0.012* [0.006]
Constant	1.472*** [0.023]	2.183*** [0.061]	0.622*** [0.026]	1.452*** [0.023]	0.621*** [0.026]	1.503*** [0.022]
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Education Dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	22783	22783	22783	22783	22783	22783
Adjusted R^2	0.554	0.166	0.023	0.554	0.024	0.553

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets;

Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 11

OLS regression analyses examining relationships among fertility intention, sense of optimism, positive beliefs, and life satisfaction with sample restriction to those currently with one child

Dependent Var.	Intention (7)	Optimistic (8)	Env.Belief (9)	Intention (10)	Env.Belief (11)	Intention (12)
Age	-0.031*** [0.001]	-0.004* [0.002]	0.003*** [0.001]	-0.031*** [0.001]	0.003*** [0.001]	-0.031*** [0.001]
Sex	-0.133*** [0.013]	0.091** [0.031]	0.046** [0.015]	-0.134*** [0.013]	0.045** [0.015]	-0.132*** [0.013]
Out of Marriage (Ref: Single)	-0.053* [0.022]	0.078 [0.053]	-0.04 [0.025]	-0.056* [0.022]	-0.042+ [0.025]	-0.052* [0.022]
Married (Ref: Single)	0.057** [0.018]	0.118** [0.036]	0.004 [0.016]	0.058** [0.018]	0.003 [0.016]	0.064*** [0.018]
Employed (Ref: Not)	-0.048** [0.015]	0.017 [0.035]	0.037* [0.016]	-0.045** [0.015]	0.037* [0.016]	-0.044** [0.015]
Personal Income	0.002 [0.004]	0.000 [0.012]	-0.004 [0.005]	0.002 [0.004]	-0.003 [0.005]	0.002 [0.004]

Risk Taking Preference	0.001 [0.002]	0.043*** [0.006]	0.000 [0.003]	0.001 [0.002]	-0.001 [0.003]	0.003 [0.002]
Life Satisfaction	0.020*** [0.004]	0.212*** [0.012]	0.008+ [0.005]	- -	- -	- -
Optimistic	- -	- -	- -	0.030*** [0.007]	0.022** [0.007]	- -
Environmental Belief	- -	- -	- -	- -	- -	0.042** [0.015]
Constant	1.700*** [0.070]	2.029*** [0.161]	0.626*** [0.068]	1.699*** [0.070]	0.596*** [0.069]	1.757*** [0.069]
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Education Dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	4055	4055	4055	4055	4055	4055
Adjusted R^2	0.424	0.177	0.025	0.423	0.027	0.421

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets; Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

IV. DISCUSSIONS

4.1. Overall Findings and Implications

The current thesis attempted to ascertain factors related to the likelihood of having a second child. First, it was hypothesized that having higher level of overall life satisfaction across the time when parents had their first child should cause greater likelihood of having a second child in the follow-up. The results strongly supported the hypothesis. The OLS estimates, including ones from robustness analyses, were in the expected direction, and their magnitude were generally stronger than or in-line with those reported in literatures (e.g., Le Moglie et al., 2015; Parr, 2010; Perelli-Harris, 2006). Furthermore, as anticipated in the hypothesis, when biases were corrected, the IV estimations of the average life satisfaction displayed greater coefficients, indicating existence of downward biases in the OLS estimates. Moreover, as a confirmatory support, the result of IV-Probit analysis also showed a significant effect as expected with similar marginal effect, further adding to the confidence in concluding there is a positive causal impact of averaged life satisfaction level on further parity progression. In addition, a number of OLS analyses examining the mechanism of relationship in the

robustness check section seemed to provide additional support by showing that higher life satisfaction level is indeed associated with higher sense of optimism, which in turn is related to greater probability of having higher parity fertility intentions. The reason, presumably, is because highly satisfied people tend to show perseverance and longer-term outlooks, which contribute to them having greater propensity to believe that positive outcomes will occur (e.g., Brand et al., 2010; Ifcher & Zarghamee, 2011; Robinson & Hippel, 2006; Tremblay et al., 2006).

Based on these findings, few policy implications can be drawn. First, as the fertility choice in modern developed society is largely a reasoned choice, targeting general level of life satisfaction seems to be a viable and appropriate way of facilitating the fertility decision-making in such societies. Indeed, enhancing life satisfaction of people does not coerce or incentivize people into having more children per se, and as such, it cannot be considered as a paternalistic policy, which may be objected by some groups. In addition, pursuit of life satisfaction is an ultimate goal in itself and will have far-reaching consequences in other domains of life as well. This means that implementing measures to increase life satisfaction is a cost-effective policy that could achieve multiple objectives of a government (e.g., lowering mortality rates [Koivumaa-Honkanen et al., 2000]). Specific ways in which this may be achieved is out of scope for this thesis; here, it is suffice to say that because the overall life satisfaction is domain neutral, the increase does not necessary have to be fertility related but rather may cover diverse aspect of lives.

As for the hypothesis concerning the drop in life satisfaction, it was predicted that experiencing greater drop in life satisfaction across the first fertility period would decrease parents' likelihood of having a second child. Here, results were weaker than in the case of

average life satisfaction. Nonetheless, in most analyses, the results were at least marginally significant. For instance, the variable was found to be significant in the OLS as well as IV-Probit analyses, but it failed to reach statistical significance when IV-LPMs were used, which could be due to general inefficiency of IV approach. In terms of the magnitude of the effect, the drop in life satisfaction implied substantial impact as one standard deviation in the amount of drop caused as much as 23% decline in the overall probability of having a second child; about five times the impact previously reported by Margolis and Myrskylä (2015). Overall, consistent with previous studies (e.g., Margolis & Myrskylä, 2015; Newman, 2008), the collection of results in the current study seemed to provide converging empirical evidence to support the claim that first fertility experiences, as reflected by the drop in life satisfaction during that period, matter for the second parity progression. Accordingly, several implications can be derived from these results. First point concerns itself with the timing of intervention or window of opportunity. More specifically, to promote further fertility behaviors, the critical window for assistance should be *during the first fertility period* as they seem to have lasting influence on fertility attitudes. Imagine receiving childcare services long after the birth of a child. In relativistic terms, it loses its significance because the service missed the most critical period in which it may be useful. The consequence from such mishap is that people would reform their fertility attitudes in more negative ways than otherwise. The point is that to promote positive fertility attitude and behavior, it is important to make childbearing and rearing enjoyable experiences, and the current findings are indicating that the first parity period is more important than otherwise. At the same time, another interesting implication may be that reducing high anticipation going into the pregnancy and childbearing stages with education may help reduce the drop in life satisfaction following the birth of child. If effective, this could be a cost-efficient policy intervention to promote higher parity progression in advanced economies.

4.2. Limitations

Although the current study endeavored to limit potential confounding factors, there may still be areas of concern. For instance, validity of the instruments may be questioned. It is conceivable that those who meet friends and relative more frequently may receive childcare support from them. To guard against this possibility, all the models where applicable included a dummy variable indicating whether respondents were receiving childcare from friends and relatives among others. As a consequence, the frequency of meeting as an instrument can be reasonably assumed to be exogenous. Additionally, the three instruments were not conceptually related to each other. Given that over-identification tests were never statistically significant and that instruments would have acted independent of each other reinforces the assumption that instruments were exogenous.

A related issue is that the IV estimation of the drop in life satisfaction effect was not strongly consistent. This was arguably due to the instruments being relatively weak predictors of the drop in life satisfaction especially those in the section 3.4.1 in which timing of covariates were altered. Although it might not have been possible to estimate true impact of the drop in life satisfaction, at the least the findings implied potential upper bound (IV estimates) and lower bounds (OLS estimates). Nonetheless, the findings for the IV drop in life satisfaction should be viewed with caution.

On the other hand, generalizability of findings here may be questioned. For a developed country, the total fertility rate of the United Kingdom is fairly high at 1.83 per woman (McLaren, 2015), which may elicit some doubts as to how relevant these findings are to the lowest low fertility regions such as Hong Kong, Japan, and South Korea. Consider, however, these countries are also places where life satisfaction is generally lower than other developed

nations with relatively high fertility rates such as Finland, France, and Australia, it is quite likely that improvement in life satisfaction during the first child period should also positively translate into higher second parity progression especially because families tend to have at least one child. As such, the findings here may actually be quite applicable to these lowest low regions.

V. CONCLUSIONS

The present thesis set out to investigate whether being satisfied with one's life during first parity period can have measurable impacts on his or her decision to have a second child. It was generally found that life satisfaction is indeed an important aspect of fertility decision making and having higher life satisfaction can positively attribute to having a second child. At a time when much interest has been garnered around the subjective well-being of citizens, the current paper, despite its limitations, attempted to contribute to growing literatures by providing new light on previous studies and to display reasons as to why subjective well-being matters to society above and beyond the philosophical reasons.

APPENDIX A

Replications of previous studies

Table A-1. *Random-effect probit estimations replicating Le Moglie et al. (2015).*

Life Satisfaction	0.060***
	[0.014]
Age	-0.080***
	[0.002]
Gender (Ref: Male)	-0.197***
	[0.033]
Education (Ref: 12 or less)	0.259***
	[0.032]
Cohabitation (Ref: Single)	0.534***
	[0.065]
Married (Ref: Single)	0.660***
	[0.063]
Log Adjusted Household Income	0.01
	[0.022]
Housing Status (Ref: Rented)	0.130**
	[0.041]
Total Working Hour	-0.003***
	[0.001]
Perceived Health	0.006
	[0.018]
Openness	0.019
	[0.015]
Conscientiousness	0.008
	[0.016]
Extraversion	-0.02
	[0.015]
Agreeableness	0.027
	[0.022]
Neuroticism	0.005
	[0.022]
Year	0.004
	[0.006]
_cons	-0.11
	[0.294]
Region Dummy	Yes
Observations	68029

Note: Sample was restricted to those with at least one child to investigate progression to second child. All variables are lagged 1-year except for the dependent variable; the dependent variable was whether a respondent had birth of second child or not on that wave; total working hour included total of job working hour, job over time hour, second job working hour, and household work hour (all measured in per week); perceived health ranged from 1 (*Very poor*) to 5 (*Excellent*); standard errors in brackets; significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table A-2. *Cox hazard proportional model replicating Margolis and Myrskylä (2015).*

Life Satisfaction Drop	-0.089*
	[0.045]
Age at first birth	-0.041***
	[0.008]
Gender (Ref: Male)	-0.380***
	[0.057]
Education (Ref: 12 or less)	0.438***
	[0.086]
Cohabitation (Ref: Single)	-1.513***
	[0.230]
Married (Ref: Single)	0.697***
	[0.125]
Log Adjusted Household Income	-0.071
	[0.051]
Job status (Ref: No)	-1.031***
	[0.082]
Region Dummy	Yes
Observations	4087

Note: Robust standard errors clustered on household ID was used for all analyses; Standard errors in brackets; Significance levels are represented by + $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$

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