More Happiness = More Babies?
A Macroeconomic Study on the Effect of Subjective Well-being on Fertility Rates

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Abstract

This paper expands the current microeconomic research on the effect of happiness, or subjective well-being, on fertility rates by examining the trends on a macroeconomic level. The effects are studied using panel data analysis on 97 countries over a time period of 2006-2015. Data on happiness is collected from the World Happiness Report 2017 and data on fertility rates is collected from the World Bank DataBank. This paper finds that subjective well-being has a significant positive effect on fertility rates in developed countries, but in undeveloped countries this effect is insignificant. Furthermore, variables that reflect self-fulfilment (such as freedom to make life choices) tend to have significant effects on fertility in developed countries. In undeveloped countries however, socio-economic variables (such as GDP and life expectancy at birth) tend to have significant effects on fertility. These results have significant political and socio-economic implications for developed countries struggling to increase their fertility rates back to the replacement level.

Introduction

Fertility rates across the globe have seen a steady decline since the 1970s. In more recent decades, whilst fertility rates continue decreasing in developed countries, this decrease has stagnated. In less developed countries however, the fall in fertility rates are comparable to those in developed countries in the 1970s. This is because fertility rates in developed countries now tend to float around the replacement rate, whereas those in less developed countries are still above it, usually by a large margin (The World Bank, 2017). It is generally assumed that the replacement rate is 2.1 births per woman, although this has been disputed (Espenshade et al., 2003). This number stems from the fact that a female and a male have to be replaced in society, with the addition of child mortality rates being taken into account. What Espenshade et al. (2003) argue is that the child mortality factor – 0.1 in this case – is much larger in less developed countries, where child mortality rates are also larger. In developed countries however, they find that the level of replacement is typically within 0.1 of 2.1. Since countries strive to continue developing, it is acceptable to assume the global replacement rate to be 2.1 in the long-run.

These trends, accompanied with academic research, have shown that increases (with exceptions) in the social structure of an economy – income, education, health, and women's increasing role in society, for example – play a role in decreasing fertility rates. Governments in developed countries have begun to worry about the socio-economic consequences of a dropping population. These negative effects occur more due to the structure of the population, rather than the reduction in its size (Sleebos, 2003). This is often described as an increase in the dependency ratio, meaning an increase in the ratio between the dependent population and that of working age.

The main consequence of a larger dependency ratio is the negative impact on social security and public finances. In many countries, pensions are funded by contributions of workers and an increasingly ageing population compromises the equilibrium of social security systems in general – pensions, health, and services for the elderly. The increasing funds needed to support social security systems for the elderly will hinder other government expenditures. This path also leads to lower domestic savings, an increase in current account deficits, and greater capital inflows from abroad needed to sustain current exchange rates (Sleebos, 2003). Furthermore,

these problems are not so distant in the future as we may expect, but are starting to begin now. A study by the European Commission in 2006 forecasted that in EU-25 nations between the years 2004 and 2050 public spending will increase by 10% due to an increase in the dependency ratio (European Commission, 2006). The pressure of this effect will become pronounced between 2020 and 2040.

The less visible consequences of fertility declines will also be significant, but possibly even more complex to deal with. One example includes changes in intergenerational ties as the ratio of elderly people within a population will increase and children will have less amounts of siblings or other children of the same age growing up with them. Another consequence is possible tensions arising economically and politically due to a larger and healthier group of elderly within the government and firms that may hinder the progression of younger people and the economy (The Netherlands Scientific Council for Government Policy (WWR), 2000). Other consequences present problems on a global scale. Lower growth and lower populations in developed countries as opposed to relatively higher growth and larger populations in developing countries can lead to possible shifts in political weights of countries in the international scene (Sleebos, 2003).

Fortunately, governments in developed countries are aware of these problems and are laying down the foundations for policies to come. Policies that aim to affect fertility levels can be divided into two categories; those that influence fertility rates directly – by offering financial incentives to families – and those that influence fertility rates indirectly – policies that change the environment in which women/couples decide how many children to have (Hugo, 2000). Examples of direct pronatalist policies involve cash payments for each child, taxation incentives related to children, and others. Examples of indirect pronatalist policies may include reconciling the professional and family responsibilities of individuals or promoting gender equity within society.

A direct measure that governments have been focused on – although likely for different reasons – is promoting employment and longer working lives of better quality. Recent studies have found that there is a positive relationship between fertility rates and female labor participation in OECD countries, contrary to the long-time trends before that (Ahn & Mira 2002; Adsera, 2004). These studies show that in OECD countries with employment certainty, women tend to have higher fertility rates – whether it's due to the maternity benefits in countries such as

Norway, or the high chance of regaining employment in highly flexible markets like in the United States. Furthermore, the studies also show that in OECD countries with employment uncertainty and fixed-term (unstable) contracts, fertility rates are depressed in the age ranges of 20-24 and 25-29. This is because during times of labor market instability, having a child may sharply decrease lifetime income and increase employment uncertainty. These effects show that some direct pronatalist policies may have benefits in other areas, meaning that governments should be willing to conduct further research in this field.

Looking at indirect pronatalist policies, it is difficult to find the possible indirect measures to promote demographic renewal governments may use, besides the increasingly popular promotion of gender equity within society. In this paper it is argued that happiness (satisfaction), or subjective well-being (SWB) within a society is a variable of interest as an indirect pronatalist measure. Past literature on happiness has studied the variable as a dependent one, but seeing as attaining and increasing the well-being of its citizens is a main (indirect) task of the government, happiness can be a variable of interest in explaining fertility rates and policies to achieve fertility goals.

This paper tries to formulate a rationale as to why happiness is an important indicator for fertility and how happiness will be an important variable to affect potential consequences of low fertility levels in developing countries. Then, it will try to estimate the complete effect of happiness on fertility by using data from the World Happiness Report 2017, which consists of SWB data from 96 countries over 10 years.

Literature Review

In order to find the total effect of happiness on fertility, we must first understand the theories of childbearing and how happiness falls within those boundaries. Women's childbearing decision theories have changed over time. In his book *"A Treatise on the Family"*, Gary Becker (1981) introduced a model of fertility where an individual's decision to have a child is one of utility maximization. This depends on the costs and benefits of having children, subject to constraints such as income and personal preference. Over time, studies have distanced themselves from such 'rational choice' models. Instead, they state the importance of the changing surrounding environment affecting the decision to have a child, stressing cultural and

institutional constraints to that decision-making process (Sleebos, 2003). This highlights an importance in the 'indirect policies' mentioned in the paper by Hugo (2000), which influence fertility decision-making by changing the environment surrounding the decision of women/couples to have a child.

The root of these 'indirect' fertility effects stems from the influential paper by Lesthaeghe and van de Kaa in 1986 called *"Twee demografische transities?"* – an article which would be translated, edited and contextualized over time by the same authors. They introduce their theory of a Second Demographic Transition (SDT), which states that with shifts in norms toward progressiveness and individualism, populations will face declining sizes due to the disconnect between marriage and procreation, increase in co-habitation, and the decision to have a child increasingly becoming a deliberate choice of achieving greater self-fulfilment (van de Kaa, 1987; Lesthaeghe, 2015). This, accompanied with an increasing ratio of elderly people within a population, can bring major economic problems.

Ogawa & Retherford (1993) find empirical evidence of this theory in Japan by looking at fertility trends, socioeconomic determinants and preferences, from 1950 onwards. They do this by using national fertility rate data going back to 1950 and by using different national surveys taken between the years of 1986 and 1992. Furthermore, their results are detailed by adjusting for different age ranges, occupations, educational levels and marital statuses, to name a few. Their results show that the decline in fertility rates since 1973 have occurred due to the postponement of marriage and increasing the age at marriage. Additionally, Japan is turning into a society where marriage and procreation are no longer tightly linked (Ogawa and Retherford, 1993). These are exact 'symptoms' that Lesthaeghe and van de Kaa predict with their SDT theory.

More empirical evidence of the beginning of a SDT is found in other developed countries as well, mainly within Europe (van de Kaa, 2002). The author looks at demographic observations within developed regions at the time (Europe, North America, Australia, New Zealand and Japan, according to the UN) between the years of 1965 and 1995. Demographic observations include the age of fertility, completed family size, cohabitation trends and contraceptive practices, amongst others. The results find that "*cohabiting, having a child outside marriage, not seeking religious or communal approval of a relationship, and ending a marriage through divorce, are good examples of new behaviors which is spreading more slowly in some of the*

countries of Southern Europe and Japan, than in Western or Northern Europe" (van de Kaa, 2002). Behavior depends on how well new ideas can be incorporated into traditions, something that is taking a longer time in Southern European countries and Japan because it is taking them longer to develop and become more progressive than Western or Northern Europe (van de Kaa, 2002). These findings support the SDT hypothesis on how childbearing will continuously evolve into a choice of achieving greater self-fulfilment as countries develop.

With developed countries beginning their Second Demographic Transition and developing countries coming up on the horizon, it is important to understand the consequences of dangerously low fertility rates and how to prevent these moving forward. Indeed, policy makers in Europe have not yet decided whether to make fertility rates an explicit objective of government policies. There is considerable opposition to direct government interference with pronatalist policies, yet it is combined with unease towards low fertility levels (Lutz, 2007). The topic of fertility is a relevant topic for developed governments today, and using happiness as a measure to act upon fertility levels may not bring objection from citizens, thus happiness is important to research further.

Seeing how the decision to bear a child will increasingly become a decision of achieving greater self-fulfilment, happiness will also be an increasingly important variable in fertility analysis. As countries become more developed and social norms shift toward progressiveness and individualism, these factors will increasingly become more important to subjective well-being, to the expense of income and job certainty, for example. This is because socio-economic factors, such as the aforementioned income and job certainty, will become more stable as countries become more developed. Therefore, since personal happiness will increasingly be more determined by factors of self-fulfilment rather than socio-economic factors, happiness will play an important role in the decision to bear children going forward. This encapsulates the motivation of this paper in finding the effect of happiness on fertility rates and how this effect changes depending on how developed a country may be.

After delving into the importance of the relationship between happiness and fertility rates, this paper now looks at past studies analyzing these variables. Studies that analyze individual-level determinants of happiness use similar independent variables used to study fertility rates. These factors include income, employment levels and certainty, health, and education levels (Headey & Wooden 2004; Parr 2005; Easterlin 2006; Caroll 2007). On a larger scale, the World

Happiness Report uses (in addition to individual surveys on SWB) national economic variables, such as GDP per capita and relative levels of democracy, to capture global happiness per country. Most literature on happiness has developed by using SWB as the dependent variable and finding its determinants.

Since SWB and fertility co-vary with many factors, there is a large history of literature that focuses on the relationship between the two variables. There are both empirical and theoretical reasons as to why satisfaction levels can be both a consequence and determinant of fertility (Parr, 2010). However, whereas most past literature has focused on satisfaction as a consequence of fertility, there has been little economic literature studied on satisfaction as a determinant of fertility.

The paper *"Satisfaction with life as an antecedent of fertility: Partner + Happiness = Children?"* by Parr (2010) leads the field on this topic and this literature comes to the conclusion that prior satisfaction in life leads to an increase in fertility amongst individuals, for both sexes. In this paper, longitudinal data was collected nationwide in Australia annually, over a 5-year period between 2001 and 2005. Data regarding subjective well-being and other control factors such as education, income, and employment was collected. In the final (fifth) year, a wide range of data on fertility was collected. This data includes whether the respondent ever had co-resident children, non-resident children or deceased children, or gave birth to or fathered a child in the 12 months prior to the final wave of data collection. This way, the satisfaction measurements taken in Wave 3 would not have been affected by the pregnancies or the births of children born 12 months prior to Wave 5 (Parr, 2010). The paper concludes with the findings that those with higher prior satisfaction in life have relatively higher fertility rates and those dissatisfied with life have strikingly low fertility rates. These differences, according to Parr (2010), can be attributed to demographic and socio-economic characteristics such as cohabiting unions and employment. This conclusion shows how socio-economic factors still play a major role in fertility decision in developed countries. However, as stated earlier in this section, this paper predicts that these socio-economic factors will have a decreasing role of importance moving forward as countries become more developed, which further enhances the motivation of this paper to research the effect of happiness on fertility rates on a global scale.

There is also literature that expects lower fertility amongst those that are more satisfied (Ramu, 1984). One reason for this is aversion of lifestyle change. If it is assumed that those not willing

to change their current lifestyle are highly satisfied in life, then these high levels of satisfaction may be related to lower fertility (Ramu, 1984). Lifestyle, or the way a person lives on a day-to-day basis, is based upon socio-economic variables such as income and employment, however. This is different from self-fulfilment, which can be seen as the personal utility gained from the ability to fulfill one's wants, which in developed countries is increasingly diverging from socio-economic factors due to the strength and stability of these factors. This paper therefore believes that Ramu's (1984) findings support this paper's arguments, rather than contradict them. As countries become developed, people will have better suited lifestyles and this may lower fertility due to aversion of lifestyle change. This has been observed in developed countries – with higher educational, health, income, and job levels, people can have better lifestyles. However, as socio-economic variables become a 'constant' as countries increasingly become more developed, it will be variables of self-fulfilment – such as happiness – that will affect fertility rates. Ramu's (1984) paper does not touch upon this second part, which this paper hopes to accomplish. This further strengthens the motives of this paper to research the effect of subjective well-being on fertility.

It is also important to briefly discuss the direction of causality. As mentioned earlier, most academic literature focuses on happiness as a consequence of fertility instead of the other way around. Studies are typically performed at a microeconomic level and the research looks into whether having children increases happiness depending on marital status, age, gender, and socio-economic circumstances, to name a few (Glenn & McLanahan, 1982; Kohler et al., 2005; Baranowska & Matysiak, 2011; Hansen, 2012; Myrskylä & Margolis, 2014). However, the scope of this paper is different, which is to find the effect of happiness on fertility, as research shows that happiness may have an increasingly important role in affecting low fertility rates in the future. Parr (2010) uses lags of happiness (minimum) 2 years prior to the fertility rate year analyzed to account for reverse causality. However, in this paper macroeconomic data is used instead of microeconomic data in order to find a general, global trend on the effect of happiness on fertility. The sample of people surveyed for answering subjective well-being questions obtained by The World Happiness report is not linked with any specific observation of 'becoming a parent' in a certain year. Furthermore, data gathered for the World Happiness Report of any year was gathered using a small sample of the population of each country that year, whereas fertility rates are national averages of children per woman, per country, of all women in that country. This means that the data on national-level subjective well-being responses and fertility rates in a certain country are loosely related in any specific year or prior

years. Therefore, by using data on the national level, reverse causality is not an issue. Nonetheless, this paper will use lags of happiness in order to estimate fertility rates, but for different reasons which will be explained in the methodology.

Based on the existing literature this paper predicts that happiness will have a positive effect on fertility, but will differ in magnitude depending on the extent of how developed the country is. In developed countries, where self-fulfilment is increasing in importance and there are relatively high incomes and job certainty, happiness will have a relatively larger effect on fertility rates. In less developed countries, where socio-economic indicators such as income and employment certainty are lower, happiness will have a relatively smaller effect on fertility rates.

Data

Happiness Data

The data on happiness is taken from the World Happiness Report 2017. Happiness levels are reported based on roughly 1,000 individual life evaluations per year in each of 146 countries. Life evaluations are determined by answering the Centril ladder question*: "Please imagine a ladder, with steps numbered from 0 at the bottom and 10 at the top. The top of the ladder represents the best possible life for you. On which step of the ladder would you say you personally feel you stand at this time?"* (World Happiness Report, 2017). The national average answer to this question is the measure that will be used in this paper as the representative variable for SWB/happiness and this variable will be called *Lifeladder*.

The 2017 report includes the data from previous reports up until the first issue published in 2012, which has data and happiness levels dating back to 2005. Data on SWB is therefore obtained from 2005-2016. Not all countries were researched from the beginning, thus happiness observations in some countries – that tend to be more developed - start as early as 2005, and each year more countries begin to be observed. In order to have reliable panel data, only countries with SWB observations between the ten year period of 2006 to 2015 were chosen. The total number of countries that follow this criteria is 97 and they can be seen in Table A1 in the Appendix.

The Organisation for Economic Co-operation and Development (OECD) released guidelines in 2012 on how to measure subjective well-being. It recommended using questions on assessing life satisfaction from 0 to 10, followed by questions on whether respondents felt they had a purpose or meaning in their lives (World Happiness Report, 2017). The OECD has found that this is the best way to measure subjective well-being. One of the reasons is that this combats respondents basing their answers too heavily on specific proxies, such as income. The World Happiness Report adds support as to why this methodology is good in measuring subjective well-being, as *"life evaluations provide the most informative measures for international comparisons because they capture the overall quality of life as a whole in a more complete and stable way than do emotional reports based on daily experiences."* (World Happiness Report, 2017). They support this claim with two facts: that life evaluations vary more than emotions do from country-to-country, and that these life evaluations are based more on life circumstances than emotional reports are, as emotional reports tend to be biased based on recent life situations and whether or not the responder answered the question on a weekend (World Happiness Report, 2017). Seeing as this paper is researching the effect of SWB on fertility rates on a global scale, these claims strongly indicate that the data is comparable on a global scale, enhancing the validity of this paper's results. Furthermore, six variables explain 75% of average life evaluations per country: logGDP per capita, social support, healthy life expectancy at birth, freedom to make life choices, generosity, and corruption (World Happiness Report, 2017). This shows that even as the life evaluations are reported on an individual-level basis, national variables affect respondents' answers and are thus comparable on a global scale.

The mean response to the Centril ladder question across the globe is 5.310, with almost 25% of respondents answering with a 5. The tendency for respondents to place themselves in the middle is a common measurement challenge in life satisfaction literature (Ferriss, 2002). However, when looking at the respondents from different regions of the world, the mean response differs widely. In a group of North America, Australia and New Zealand the mean response is 7.046, whilst in South Asia it is 4.442. The standard deviation of responses also varies – on a global scale, the standard deviation of responses is 2.284. For more developed areas of the world the standard deviation drops below 2.0, whereas for less developed areas it stays around 2.1. Since both the means and standard deviations between different regions in the world differ, this paper believes there is enough variation in SWB data to examine the relationship between happiness and fertility rates.

Some of the variables that explain the average life evaluations per country are used as control variables on fertility rates. LogGDP per capita is accounted for as the proxy for national income. Healthy life expectancy at birth is taken as the health indicator, which is an important factor for fertility rates. Furthermore, more variables are used, such as proxies for democracy and freedom to make life choices to account for personal freedom. Population size is also accounted for.

Other variables that are used as control variables are mean schooling years, unemployment, the percentage of GDP attributable to agriculture and female participation in the labour force. Mean schooling years, unemployment, and female labor force participation may affect the decision of childbirth on a personal level. The percentage of GDP attributable to agriculture is an indicator which will show whether countries with higher levels of agricultural production, which tend to have more rural societies, have higher fertility rates due to the economic value of children to work.

Fertility Data

Fertility data was collected from The World Bank DataBank, which has collected years of fertility rate observations per country through the United Nations Population Division, United Nations Statistical Division, Eurostat, and statistical publications from national statistical offices, amongst other sources.

Global data on fertility rates is matched with national average happiness indicators of each country of the same year. This way, we can see how happiness levels affect fertility rates in the same year. Lagged observations of happiness levels will also be regressed onto fertility rates.

Visualizing the relationship between happiness and fertility rates

Figure 1 – Relationship between fertility rates and subjective well-being

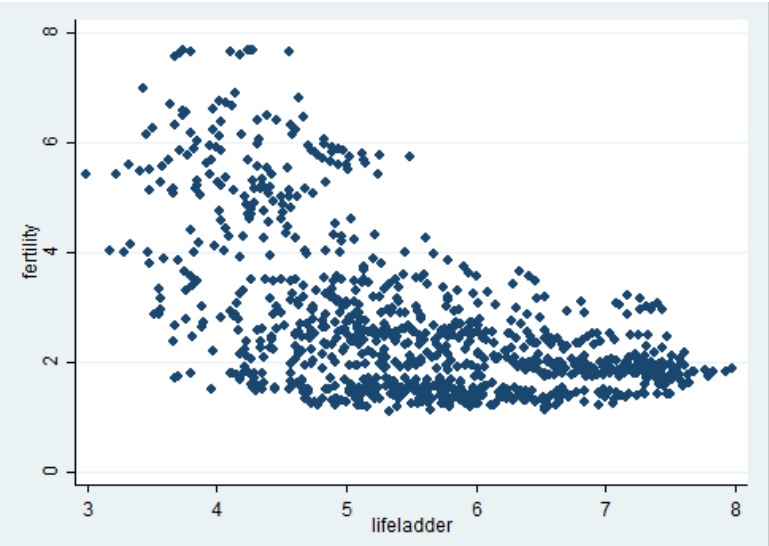

Figure 1 shows the relationship between fertility rates and national average happiness levels. Note that each observation represents the relationship between the two variables in a country in a given year. Therefore, there are 10 observations per country in this figure. We see much more variance in fertility rates in countries with a lifeladder value lower than the global mean of 5.31 than those with a lifeladder value larger than 5.31. There also seems to be a negative correlation between the two variables before evening out as countries fluctuate around the replacement rate of 2.1. This initial negative correlation is due to a selected amount of countries which are outliers in terms of fertility rates, meaning they have above 4 births per woman[1]. There are 15 countries where the fertility rate average over the 10 year period analysed is more than 4 per woman. Zimbabwe and Pakistan also fluctuate around 4 children per woman with fertility rate averages of 3.997 and 3.809, respectively. It is interesting to see that all these countries which have strikingly high fertility levels also have strikingly low average national average happiness levels. It is also worth noting how happiness observations do not seem to tend towards 5, but rather spread out evenly along the scale.

[1] In alphabetical order, these countries are Burkina Faso, Cameroon, Chad, Ghana, Kenya, Malawi, Mali, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda and Zambia.

Methodology

The dataset includes observations of 97 countries over a time period of 10 years, from 2006-2015. The dataset is strongly balanced, meaning all observations between fertility and happiness are matched for all countries, for all years. Furthermore, there are little to no missing observations for all other control variables.

To find the effect of happiness on fertility rates, panel regressions are made in a way where the model is built to correct for different econometric problems. When observing countries over time, normal Ordinary Least Squared (OLS) regressions cannot be used. This is because we are not dealing with independent random samples, but identical panel variables observed over time. Therefore, different panel data models are used, which will be explained below.

The first panel regression will be in the following form:

$$Fertility_{i,t} = \beta_0 + \beta_1 L1.lifeladder_{i,t} + \varepsilon_{i,t}$$

This regression estimates the fertility rate of a country *i*, at time *t*, using the first lag of happiness as the independent variable of interest and error term ε. Control variables are also added to reduce omitted variable bias (OVB). OVB is caused when variables that are correlated with both fertility and happiness are excluded from the regression. Their effects are captured by the error term ε and bias the coefficient of interest, β_1 . The control variables included in this paper are logGDP, life expectancy at birth, and more that were discussed in the data section above. By adding the control variables, the formula below is formed where first lag of control variable *v*, in country *i*, at time *t*, has a coefficient of β_v .

$$Fertility_{i,t} = \beta_0 + \beta_1 L1.lifeladder_{i,t} + L1.\beta_v v_{i,t} + \varepsilon_{i,t}$$

The first lag of happiness is used because most of the variation in happiness that affects fertility rates comes from the prior period. Fertility rates are calculated by calendar year, so from January to December in the same year. However, pregnancies take approximately 9 months in total from the point of conception to birth. Therefore, a child born in January of a certain year was conceived around April of the year before. Similarly, a child born in September of a certain

year was conceived around December of the year before. Therefore, 9 months – from January to September – of fertility rates in any given year are affected by happiness levels from the year before, not the same year. For similar reasons the lags of the control variables are used – if a person is unemployed, for example, it will affect their decision to have a child in the next period due to the 9 month pregnancy period.

This means we are still missing the variation of happiness (and control variables) that affects fertility rates in 3 months – October, November and December of a given year. Children born in those months were conceived around January, February and March of the same year. Therefore, some variation of happiness that affects fertility rates comes from happiness of the same year, to a certain extent. The decision to have a child is usually a decision taken over time, therefore children conceived in January of a year may have been planned to be conceived in December the year before, meaning happiness of the year before is the variable of interest, not the happiness of the current year. However, it is also difficult to find a definitive cut-off point between happiness levels between 2 years. Indeed, changes in happiness tend to be small year-by-year and in actuality there is not much difference between happiness in November of one year and February in the next year, for example. Therefore, there is a boundary of uncertainty between the two time periods. Knowing this, *lifeladder* of the current period is added in order to account for the variation of happiness from the current year that affects fertility rates in the current year, as well as perhaps some overlapping effects from happiness levels in the year prior. Hence, the following model is formed:

$$Fertility_{i,t} = \beta_0 + \beta_1 lifeladder_{i,t} + \beta_2 L1.lifeladder_{i,t} + L1.\beta_v v_{i,t} + \varepsilon_{i,t}$$

For the control variables, the boundary of uncertainty is larger than that for happiness. This is because all of the control variables are macroeconomic variables. Year-to-year changes in macroeconomic variables are minimal and month-to-month changes are even smaller, assuming no shocks. For example, life expectancy at birth and average schooling years either change by ±0.1 or do not change at all year-by-year in the data over all 10 years. Similar year-to-year changes are seen in the other control variables. Therefore, it is not necessary to include current year observations for control variables as the lagged observation contain a long-term trend in each variable – the trend before the lagged year and after, including the 3 months of variance we are looking for.

This paper will show in the results section that this is the correct model to use for the estimations, through econometric techniques. It could also be argued that the second lag of happiness could have an effect on fertility rates of a certain year. If the decision to make a child takes a long time and a child conceived in April of the year prior affects fertility rates of the current year since the child is born in January, happiness levels from 2 years prior may be significant. This paper believes this effect to be minimal and is nonetheless encompassed in the lagged variable of happiness through the boundary of uncertainty. Evidence supporting this is found in the results section.

As mentioned in earlier sections of this paper, happiness affects fertility but fertility also affects happiness. Past academic research such as Parr (2005) use two lags of happiness in order to see its effect on fertility rates, in order to make sure the pregnancy of the woman does not affect her happiness levels. However, reverse causality is not a problem here due to the macroeconomic scope of this paper. The fertility rates used in this paper are national fertility rate levels. The happiness observations are national averages on subjective well-being taken from a sub-sample of a country's population. Therefore, the two variables are not directly associated with each other, much like in other microeconomic studies. Hence, reverse causality is not an issue in this paper.

All regressions in the paper will be estimated using country fixed effects. This means that happiness will be regressed onto fertility rates within each country over time. Each country has its own individual characteristics that may affect fertility rates in that specific country, such as culture or traditions, for example. Fixed effects control for this bias by removing the effects from these time invariant variables on the independent variables and error term. An important assumption of fixed effects, however, is that these time-invariant characteristics are unique to each country. This may not hold true in our case. For example, religion can have a large influence on fertility rates within a country. But religions and their values are shared amongst countries, meaning fixed effects may be bias in the case of this paper. In order to see whether a random effects model or fixed effects model should be used, a Hausman Test is estimated. For our model of interest, which will be explained in the results section, there is a clear preference for the fixed effects model as the Hausman Test has a p-value of 0.000.

The model created to estimate the effect of happiness on fertility rates will be used to see this effect in five settings: globally, in developed and undeveloped countries, in happier and less

happy countries, in countries with high child labor and in countries with high/low percentage of GDP attributable to agriculture.

Results

First Estimations

The results in Table 1 below show the first estimates of SWB on fertility rates. Column (1) shows the effect of only the first lag (L1) of *lifeladder* on fertility, whilst column (2) adds the control variables where the first lag of each variable is also used, as explained in the methodology. Furthermore, both models include fixed effects, as will all the estimates moving forward.

Table 1 – Effect of SWB on Fertility, including control variables

	(1) fertility	(2) fertility
L1.lifeladder	0.010	0.045***
	(0.0133)	(0.012)
L1.loggdp		-0.365***
		(0.067)
L1.schooling		-0.024
		(0.015)
L1.lifeexpbirth		-0.040***
		(0.004)
L1.unemploy		-0.003
		(0.003)
L1.democracy		-0.065*
		(0.030)
L1.freedom		-0.211**
		(0.066)
L1.agrigdp		-0.012***
		(0.002)
L1.femlabor		-0.009

		(0.005)
L1.popmil		8.66e-09 (1.95e-08)
_cons	2.599***	9.518***
	(0.0747)	(0.545)
N	873	753

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The coefficient of *lifeladder* increases from 0.010 to 0.045 when adding control variables and also becomes significant at 99% certainty. Furthermore, the standard error of the coefficient remains relatively stable. These results show that the effect of *lifeladder* is biased in column (1) due to the omitted control variables. By including the control variables in the regressions, a more accurate effect of SWB on fertility is shown. The coefficient of *lifeladder* is underestimated in column (1) without the control variables as almost all of the control variables have a negative effect of fertility rates and the coefficient of *lifeladder* 'absorbs' their effects, since they are omitted.

Lifeexpbirth has a significant negative effect of -0.040 on fertility rates, at a 99.9% certainty. The negative effect of life expectancy at birth on fertility rates is a surprise. One would assume that as life expectancy at birth increases, individuals would be more likely to have children as the children can live long, healthy lives. Yet, the estimated coefficient shows that an increase in life expectancy at birth of 10 years within a country will decrease fertility rates by 0.40 percentage points, which is a large effect. This result is likely to be caused by the correlation between life expectancy at birth and other independent variables. Indeed, the correlation of *lifeexpbirth* is larger (in absolute terms) than 0.6 with 4 variables; *lifeladder*, *loggdp, schooling,* and *agrigdp*. It is logical that *lifeexpbirth* is highly correlated with these other independent variables – the people in countries with higher life expectancies at birth will be happier, have better social support and infrastructure to boost prosperity, stay in school longer, and will likely be in manufacturing or service jobs rather than agriculture (*agrigdp* was the only variable negatively correlated with *lifeexpbirth*). This shows that the *lifeexpbirth* coefficient is likely unreliable, even though it appears to be highly significant in the estimations.

Loggdp and *agrigdp* also have significant negative effects at a 99.9% certainty. The *loggdp* estimate shows that if GDP increases by 10%, fertility rates will decrease by 0.0365 percentage

points. This result is a good representation of the differences in fertility rates between developed and undeveloped countries, where fertility levels vary greatly between the two. Similarly, the *agrigdp* estimate shows that a one percentage point increase in the percentage of GDP attributable to agriculture within a country will make fertility rates decline by 0.012%. Whilst a negative and significant effect is found, the estimate in Table 1 is small. This small effect could be because increases in GDP attributable to agriculture within a country have a larger effect on fertility rates in undeveloped countries or countries in transition rather than in developed countries, something this paper will focus on in the results. Since these results include all countries from the dataset, this estimated effect is smaller, as increases in GDP attributable to agriculture in more developed countries do not necessarily increase the need for families to procreate with the intention that their children will work to support the family.

Also observed is a -0.211 effect of *freedom* on fertility rates, at a 99% certainty level. As *freedom* ranges from 0 to 1 – 1 being as free to make life choices as one believes can be – this coefficient can be interpreted as the following: In a country where people believe they are as free to make life choices as one assumes can be, fertility rates are lower by 0.211 compared to a country where people believe they have no freedom to make life choices at all, *ceteris paribus*. This effect shows support to van de Kaa (1987) and Lesthaeghe's (2015) papers on how the decision to procreate is increasingly one of self-fulfilment as countries become more developed, since it is also developed countries that tend to have higher *freedom* levels in the dataset. The negative effect of *democracy* on fertility rates shows similar support to the theory of Second Demographic Transition, as democratic nations tend to be more developed in the data set as well, and this effect is at a 95% certainty level.

It is interesting to see that *schooling*, *unemployment*, and *femlabor* do not have significant effects on fertility rates. Increases in average schooling years, unemployment rates, and the percentage of labor force that are women are hypothesized in this paper to have overall negative effects on fertility rates. Although the sign of the coefficients are negative, the coefficients themselves are of low magnitude and insignificant. The estimates may be insignificant because the effects of these variables could have a larger effect on fertility rates in developed countries where, for example, employment and female labor participation rates are stronger, since developed countries tend to have low unemployment rates and high female participation rates. Thus, a change in the rates of these variables in developed countries may have a larger effect on fertility rates whereas in less developed countries, where employment rates are less certain

and female participation rates are low, changes in these rates may not affect fertility rates to the same magnitude. Alternatively, it is also possible that the effects of these variables on fertility rates are non-linear. For example, in developed countries an increase in female labor participation may increase fertility as now the family can more easily support having a child and it is more likely that the father can stay at home and raise the child, since wages are higher, for example. In less developed countries, however, an increase in female labor participation may decrease fertility rates as more women work, focus on their careers, and postpone maternity. The regressions later in this paper that use data from developed and undeveloped countries, separately, will go more into detail about these possibilities.

Finally, the population of a country has no effect on fertility rates in that country. This is unsurprising as it is difficult to believe that one would think about the population of the country they live in as a reason to have or not have a child. This variable was included in the analysis to control for potential population effects on procreation within countries. Seeing as there is no effect and for simplicity moving forward, *popmil* is taken out of future regressions[2].

The Model

The regressions in Table 2 add on to the model of Column (2) from Table 1. Specifically, the first column adds *lifeladder* of the current time period analysed to the model, whilst the second column adds the second lag of *lifeladder* in addition to that. The reason for this is to find and justify the correct model to use moving forward, that is, which model gives us the most reliable results in predicting the effect of SWB on fertility rates. This reliable model is Column (1) in Table 2 and the following section will explain why.

[2] All regressions in this paper were estimated with and without the *popmil* variable. There were no differences in coefficient estimates of other variables and changes in the R^2 of each model were to the 4th decimal place. Therefore, it is safe to omit *popmil* from the estimates as it does not impact the results, nor does it affect their validity or reliability.

Table 2 – Adding *lifeladder* observations from more time periods

	(1) fertility	(2) fertility
lifeladder	0.036**	0.035**
	(0.012)	(0.011)
L1.lifeladder	0.036**	0.038***
	(0.012)	(0.011)
L2.lifeladder		0.015
		(0.011)
L1.loggdp	-0.373***	-0.397***
	(0.067)	(0.070)
L1.schooling	-0.0241	-0.025
	(0.015)	(0.011)
L1.lifeexpbirth	-0.0397***	-0.038***
	(0.004)	(0.004)
L1.unemploy	-0.003	-0.003
	(0.003)	(0.002)
L1.democracy	-0.068*	-0.052
	(0.030)	(0.028)
L1.freedom	-0.227***	-0.194**
	(0.065)	(0.062)
L1.agrigdp	-0.012***	-0.009***
	(0.002)	(0.002)
L1.femlabor	-0.009	-0.009
	(0.005)	(0.005)
_cons	9.415***	9.337***
	(0.541)	(0.570)
N	753	686

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Both *lifeladder* and *L1.lifeladder* have coefficients of 0.036 in Column (1), which are significant at the 99% level. The coefficient of *L1.lifeladder* decreases from 0.045 in Column (2) of Table 1 to 0.036 by adding the *lifeladder* variable. This is because the effect of *L1.lifeladder* on fertility is overestimated in Table 1 due to omitting *lifeladder* (the lifeladder

variable from the current time period). This overestimation is caused by the effect of *lifeladder* being 'added' onto the effect of *L1.lifeladder* because *lifeladder* is omitted. Since we see in Table 2 that the effect of *lifeladder* on fertility is a positive one and the effect of *L1.lifeladder* on fertility rates is also a positive one, the coefficient of *L1.lifeladder* is overestimated when *lifeladder* is not included in the regression in Table 1.

As mentioned above, both coefficients of 0.036 are significant at the 99% level in Table 2. However, the coefficient of *L1.lifeladder* is significant at the 99.9% level in Column (2) of Table 1. This does not necessarily mean that the coefficient of *L1.lifeladder* is less reliable in Column (1) of Table 2, however. This difference in significance levels can be due to two things. First, since the coefficient of *L1.lifeladder* was overestimated in Table 1 because it included the effect of *lifeladder*, and the effect of *lifeladder* on its own is significant, the significance of *L1.lifeladder* was also overestimated. Second, because there is no clear definition of when subjective well-being from one year ends and begins for another – the boundary of uncertainty mentioned before – the effects of each happiness observation may overlap during that transition period. Changes in SWB tend to be small year-by-year and in actuality there is not much difference between national average SWB in November of one year and February in the next one, for example. Thus, the true effects of *lifeladder* and *L1.lifeladder* cannot be precisely estimated due to the boundary of uncertainty between the two time periods. This effect may be enhanced by our data as well – SWB surveys and data may be collected in January in one country but in March in another country, for example. The point that is trying to be made, however, is that it does not matter that the significance for *L1.lifeladder* is slightly lower in Table 2 than in Table 1, considering the fact that *lifeladder* is added and that variable is significant, but it may cause some overlapping effects which lower the significance of both variables. This is also supported by the fact that the coefficients of the control variables do not change in magnitude, sign or significance when adding *lifeladder*. By having no effect on the control variables, it shows that when including the *lifeladder* variable its own effect on fertility is displayed, some of which was part of the overestimation of *L1.lifeladder* in Table 1.

In Column (2) of Table 2 we also add the second lag of lifeladder, *L2.lifeladder*. This variable has a 0.015 coefficient which is insignificant. This is understandable as subjective well-being 2 years prior to giving birth is likely to have no effect on the decision to have a child, even considering the 9-month pregnancy period. This variable's insignificance is further shown by the coefficients of *lifeladder* and *L1.lifeladder* not changing in magnitude and staying almost

the same, relative to those in Column (1). If *L2.lifeladder* had a significant effect on fertility rates, then the coefficient of *L1.lifeladder* (and perhaps, to a certain extent, *lifeladder*) would be overestimated or underestimated in Column (1), much like *L1.lifeladder* was overestimated because *lifeladder* was omitted. We can see that in this model *L1.lifeladder* is significant at the 99.9% level again, however. This is because by adding *L2.lifeladder*, the boundary of uncertainty for *L1.lifeladder* is decreased. By including *lifeladder* and *L2.lifeladder* in the model, the boundary of uncertainty on both sides of *L1.lifeladder* is made more distinct, therefore the true effect of *L1.lifeladder* can be more closely predicted. However, considering that the significance of *L1.lifeladder* increases but the coefficient only changes by 0.002, the coefficient of *lifeladder* changes by 0.001 and does not change in significance, the coefficient of *L2.lifeladder* is insignificant and that some control variables change in magnitude and to a lower significance, it is reasonable to not include *L2.lifeladder* in the model in order to retain reliability in the model. Therefore, the model from Column (1) in Table 2 is the most reliable and valid model moving forward.

Effects in developed and undeveloped countries

This paper will now show the results of the effect of happiness on fertility from different data subsets. The first estimates that will be analyzed are those between developed and undeveloped countries. The United Nations classifies countries in three main categories: developed economies, economies in transition, and developing economies (UNDESA, 2014). This section uses data from 27 of the 43 countries classified as 'developed economies' and data from 59 of the 107 countries classified as 'developing economies'. Countries classified as 'economies in transition' were not used. For clarity, this paper categorizes 'developed countries' as 'developed' and 'developing countries' as 'undeveloped'. The list of countries categorized as developed or undeveloped can be seen in Table A2 in the Appendix. The results of the estimates on the effect of happiness on fertility in developed and undeveloped countries can be seen in Table 3.

Table 3 – Effect of SWB on fertility in developed and undeveloped countries

	(developed) fertility	(undeveloped) fertility
lifeladder	0.080***	0.008
	(0.020)	(0.012)
L1.lifeladder	0.046	0.022
	(0.023)	(0.012)
L1.loggdp	0.395*	-0.668***
	(0.154)	(0.078)
L1.schooling	0.023	-0.031
	(0.020)	(0.018)
L1.lifeexpbirth	-0.033***	-0.042***
	(0.010)	(0.004)
L1.unemploy	0.007*	-0.012*
	(0.003)	(0.005)
L1.democracy	-0.161**	-0.041
	(0.062)	(0.033)
L1.freedom	0.035	-0.272***
	(0.096)	(0.073)
L1.agrigdp	-0.016	-0.010***
	(0.013)	(0.003)
L1.femlabor	-0.012	0.003
	(0.014)	(0.006)
_cons	-0.277	12.28***
	(1.406)	(0.620)
N	205	452

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Lifeladder is highly significant for developed countries. Furthermore, this effect is a positive one which is in line with this paper's hypothesis on the effect of happiness on fertility in developed countries. For undeveloped countries however, happiness is insignificant in estimating fertility rates. Moreover, there is a large difference between the two coefficients of *lifeladder* and to a smaller extent *L1.lifeladder*. This shows that an increase in happiness has a much larger effect on fertility rates in developed countries rather than undeveloped countries,

ten times more according to the coefficients of *lifeladder*. Happiness having a larger effect on fertility rates in developed countries is also in-line with the hypothesis of this paper. It is questionable as to why *L1.lifeladder* is insignificant for both groups, as one would assume the variable to follow the trend of *lifeladder*.

We can see that different control variables matter for fertility between developed and undeveloped countries. Furthermore, these differences are in line with the hypothesis of this paper for determinants of fertility in developed and undeveloped countries. In developed countries, variables more associated with satisfaction and self-fulfilment, such as *lifeladder* and *democracy*, have a significant effect on fertility rates. *Loggdp* has a positive effect for developed countries and a negative effect for undeveloped countries, meaning the relationship may be a non-linear one. For undeveloped countries, socio-economic variables have more significance in estimating fertility rates – such as *loggdp*, *unemploy*, and *agrigdp*. *Loggdp* has a negative coefficient showing that as undeveloped countries become more developed, fertility rates fall due to better life opportunities from an increase in socio-economic factors. Similarly, unemployment has a more significant impact on the decision to have a child in undeveloped countries since job certainty tends to be much lower in those countries. Furthermore, as undeveloped countries are transitioning from agricultural to manufacturing/service-based economies, the effect of agriculture as a percentage of GDP also has a more significant effect on fertility rates. This effect is negative, considering families may want less children for child labor.

It is interesting to see that *freedom* is highly significant for estimating fertility rates in undeveloped countries rather than developed countries. Significance should have been found the other way around, according to the hypothesis of this paper. However, it is important to see that the *freedom* coefficient is negative, meaning that as belief of freedom increases, fertility rates decrease. This shows that in undeveloped countries giving people more freedom to choose what they do with their lives will lower fertility rates. This may be due to socio-economic factors still being important predictors of fertility rates in those countries. Thus, in undeveloped countries, as freedom to make life choices increases, people tend to not have children in order to pursue better education, work, or wage opportunities, for example.

Life expectancy at birth is also highly significant for both types of countries, however the coefficients are negative. One would expect that if life expectancy at birth was larger, then this

would help increase the chance that people decide to have a child. A negative coefficient could show that in developed or undeveloped countries with high life expectancy people may decide to postpone having a child, which we have seen in past academic literature tends to decrease fertility rates (Ogawa & Retherford, 1993). Furthermore, it is perplexing to see that *schooling* has no effect on fertility in either developed or undeveloped countries.

Effects in less happy and happier countries

The second estimates that will be analyzed are those between less happy and happier countries. According to The World Happiness Report (2017), the population-weighted distribution of happiness has a mean of 5.310. This means that the global mean national average to the Cantril ladder question asking respondents to value their satisfaction on a 0 to 10 scale is 5.310. This number was therefore used as a divide between less happy and happier countries. That is, if the average value of all lifeladder observations from 2006-2015 for a specific country was lower than 5.31, that country was put in the 'less happy' dataset, and the opposite goes for happier countries. The list of countries categorized as happier or less happy can be seen in Table A3 in the Appendix. The results of the estimates on the effect of happiness on fertility between these datasets are shown in Table 4 below.

Table 4 – Effect of SWB on fertility in less happy and happier countries

	(happier) fertility	(less happy) fertility
lifeladder	0.022	0.022
	(0.013)	(0.018)
L1.lifeladder	0.005	0.023
	(0.013)	(0.019)
L1.loggdp	0.070	-0.553***
	(0.092)	(0.097)
L1.schooling	-0.073***	-0.099**
	(0.014)	(0.034)
L1.lifeexpbirth	-0.004	-0.035***
	(0.007)	(0.005)
L1.unemploy	-0.001	-0.002

	(0.003)	(0.006)
L1.democracy	-0.082*	-0.054
	(0.039)	(0.042)
L1.freedom	-0.288***	-0.164
	(0.075)	(0.100)
L1.agrigdp	-0.008	-0.015***
	(0.00431)	(0.003)
L1.femlabor	-0.023***	-0.011
	(0.006)	(0.009)
_cons	3.409***	11.740***
	(0.710)	(0.807)
N	421	332

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In both data subsets it can be seen that SWB does not significantly influence fertility. This shows that the effect of happiness on fertility rates does not tend to differ because countries are less happy or happier, or put differently, as national average happiness levels are on different points along the 0-10 scale. However, we can see that different control variables matter for fertility between less happy and happier countries. In less happy countries, *loggdp, lifeexpbirth,* and *agrigdp* are significant at the 99.9% level, with *schooling* being significant at the 99% level. In happier countries, however, none of these variables are significant besides *schooling,* which is significant at the 99.9% level, alongside *freedom* and *femlabor*. *Democracy* is also significant, although to a lesser extent. These results show that in less happy countries, economic variables play more importance in the decision to procreate, whereas in happier countries variables that affect the decision to procreate are ones of achieving greater self-fulfilment, such as how much freedom to make your own life choices there is.

It is no coincidence that these results are similar to those for developed and undeveloped countries. Indeed, these results are consistent with this paper's hypothesis for developed and undeveloped countries – that the decision to procreate will be a decision based more on self-fulfilment in developed countries, and in undeveloped countries it will be a decision based on socio-economic indicators. This is logical considering that in this dataset, developed countries tend to be happier and undeveloped countries tend to be less happy, as can be seen in Tables A2 and A3. Although this relationship is less clear in actuality (World Happiness Report,

2017), this does not matter for this paper's purposes. The point of these estimates was to find whether happiness affects fertility rates significantly different between happier and less happy countries, and the results show this is not the case.

Effects in countries with high child labor and high GDP attributable to agriculture

The final estimates will show the effect of happiness on fertility in countries with high child labor and then in countries with a high percentage of their GDP coming from agriculture. The first estimates will show whether happiness is a significant indicator in estimating fertility in countries where the decision to have a child is likely to be affected by the ability of that child to work from a young age, rather than a decision of self-fulfilment. Then, the second estimates will show how the effect of happiness on fertility differs between countries with high and low percentages of GDP attributable to agriculture, an indicator showing the need for children for economic purposes, such as labor.

1. Countries with high child labor

Statistics of countries with high child labor were found through reports from the International Labor Organisation (ILO). There were 130 million children aged 5-14 in employment across the globe in 2016, of which 114 million worked in child labor conditions. Additionally, 30% of those working in child labor conditions worked in hazardous conditions (International Labor Organisation, 2017). Of the 114 million children that worked in child labor conditions, approximately 102 million (88.7%) were found in two regions: Sub-Saharan Africa and Asia & the Pacific. The former had 59,966 children working in child labor conditions and the latter had 41,580 in 2016 (International Labor Organisation, 2017).

This paper uses the classification of countries in these regions by the ILO in order to select the countries for the regressions. In the ILO's lists, there are 99 countries in Sub-Saharan Africa and Asia & the Pacific. This paper uses data on 34 of those countries. Although the sub-dataset used has approximately one-third of the countries included in the ILO categories, the results below are reliable because the countries included in the dataset capture the large majority of the population. Most of the countries missing are from Sub-Saharan African, yet the dataset includes 13 of the top 20 most populous countries in that region. Furthermore, 20 of the 65 missing countries are Pacific Island nations, of which 10 have less than one million habitants

and 9 others have less than 100,000 habitants (The World Bank, 2017). The list of countries in this dataset can be seen in Table A4 in the Appendix. The results of the estimates on the effect of happiness on fertility in this dataset is shown in Table 5 below.

Table 5 – Effect of SWB on fertility in countries with high child labor

	(1) fertility
lifeladder	-0.001 (0.017)
L1.lifeladder	0.041* (0.017)
L1.loggdp	-0.906*** (0.105)
L1.schooling	0.007 (0.030)
L1.lifeexpbirth	-0.038*** (0.005)
L1.unemploy	-0.009 (0.008)
L1.democracy	-0.045 (0.042)
L1.freedom	-0.322*** (0.097)
L1.agrigdp	-0.010** (0.003)
L1.femlabor	0.002 (0.009)
_cons	13.88*** (0.900)
N	270

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Whilst *lifeladder* has a coefficient of effectively 0 and is insignificant, *L1.lifeladder* has a positive coefficient and is significant at the 95% level. The combination of these results show

that happiness does have a small effect on fertility in countries with high child labor, but this effect is also not very significant. This supports the view that happiness is not an important indicator in countries with high child labor, relative to that in countries in general.

Furthermore, the other significant variables are those that are also significant with undeveloped countries. This is reasonable seeing as most of the countries in this sub-dataset are also in the dataset of undeveloped countries. The other variable of interest in this case, *agrigdp*, is significant at the 99% level. However a negative coefficient of -0.010 shows a negative relationship between the percentage of GDP attributable to agriculture and fertility rates. This is in contrast with the hypothesis of this paper.

2. Countries with high and low percentage of GDP attributable to agriculture

The average percentage of GDP attributable to agriculture in a country over the 10-year period analysed is 11.64% in this paper's dataset, which includes 97 countries. Therefore, if the average value of all *agrigdp* observations from 2006-2015 for a specific country was lower than 11.64%, that country was put in the 'less_agri' dataset, and the opposite goes for countries with more than 11.64% *agrigdp*. There are 56 countries in the 'less_agri' dataset and 37 in the 'more_agri' dataset. The remaining 4 countries did not have data on *agrigdp*[3]. The list of countries in these datasets can be seen in Table A5 in the Appendix. The results of the estimates on the effect of happiness on fertility in these datasets is shown in Table 6 below.

Table 6 – Effect of SWB on fertility in countries with more and less than 10% *agrigdp*

	(more_agri) fertility	(less_agri) fertility
lifeladder	0.019	0.042***
	(0.018)	(0.012)
L1.lifeladder	0.030	0.026*
	(0.018)	(0.012)
L1.loggdp	-0.508***	0.081
	(0.119)	(0.068)
L1.schooling	-0.112***	-0.028*

[3] These countries are Haiti, Israel, Niger and United Arab Emirates

	(0.031)	(0.012)
L1.lifeexpbirth	-0.047***	-0.014***
	(0.006)	(0.004)
L1.unemploy	-0.004	0.002
	(0.009)	(0.002)
L1.democracy	0.015	-0.107***
	(0.043)	(0.031)
L1.freedom	-0.220*	-0.090
	(0.103)	(0.062)
L1.agrigdp	-0.016***	0.023***
	(0.003)	(0.005)
L1.femlabor	-0.015	-0.021***
	(0.008)	(0.005)
_cons	12.49***	2.980***
	(0.888)	(0.591)
N	284	469

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Happiness has a positive effect on fertility and this effect is highly significant in countries with less than average GDP attributable to agriculture. In countries with more than average *agrigdp*, happiness does not seem to be a relevant predictor for fertility rates. This seems to be because countries in the less_agri group tend to be developed and countries in the more_agri group tend to be undeveloped.

For countries within the more_agri dataset, *agrigdp* has a highly significant but negative effect on fertility rates. This is not in line with the theory that in countries with more *agrigdp*, fertility rates are higher, especially in countries with relatively high *agrigdp*.

Discussion

The first regressions using the correct model (Column 1 of Table 2) show that globally, happiness has a significant positive effect on fertility rates. This result indicates that no matter the circumstances, the decision to have a child is affected by a person's subjective well-being. This is because a person's subjective well-being can, among other reasons, help indicate to one's self that at this stage in life it is an appropriate time to conceive a child. Freedom to make life choices and democracy are also variables that one would expect to help in self-signaling and increasing fertility, as these variables are good indicators of progressiveness in the environment surrounding the population. However, these two variables show significant negative effects on fertility. An explanation for this could be because countries that have high values for these variables tend to be developed countries which have low fertility rates, whereas undeveloped countries have high fertility rates, with some abnormally high. In Table 3 we can see that freedom to make life choices has a positive effect on fertility, although insignificant, whilst there is a significant negative effect for undeveloped countries. This indicates a non-linear relationship between the two variables which may explain why overall there is a negative effect. Coming back to Column 1 of Table 2, we can see that national socio-economic variables such as logGDP per capita, life expectancy at birth, and the percentage of GDP attributable to agriculture have significant influence on fertility rates. These results show that national socio-economic variables have an influence on a person's decision to have a child or not. Considering logGDP per capita can be considered a good indicator for personal income, these results make sense. However, it is perplexing as to why life expectancy at birth has a significant negative effect on fertility rates. It is also perplexing that unemployment, average schooling years, and female labor participation have no significant effect on a global scale.

In developed countries happiness has a significant and positive effect on fertility rates, whilst in undeveloped countries there is no significant effect. Perhaps this indicates a non-linear relationship between happiness and fertility, or a relationship where the effect of happiness on fertility increases as countries become more developed. We see that happiness has the same insignificant effect on fertility rates between happy and less happy countries, showing that the difference in effect is indeed between developed and undeveloped countries rather than these two groups. The question remains as to why the effect of happiness is insignificant for both groups, however. In countries with high child labor we see that happiness does not have a

significant effect on fertility rates but socio-economic variables do. Freedom to make life choices has a strong significant negative effect on fertility, indicating that children born in countries in this sub-dataset may be conceived for economic purposes – like working on farms – rather than reasons of self-fulfilment. A similar, but less significant, effect is found in countries with a high percentage of GDP attributable to agriculture. In countries with a low percentage of GDP attributable to agriculture, happiness has a strongly significant positive effect. This further enhances the view that happiness has a more significant effect in developed countries than undeveloped countries, seeing as countries with less GDP attributable to agriculture tend to be more developed. It is questionable as to why unemployment stays insignificant throughout all regressions and to a lesser extent national schooling averages and female labor participation as well.

Conclusion

This paper hypothesized that subjective well-being, or happiness, which is represented by national averages of answers to the lifeladder question, will have a positive effect on global fertility rates. The regressions with all countries in the dataset indicate this to be true. It is important to note that whilst the relationship between the two variables is a positive one, it does not necessarily mean that countries with high national averages of lifeladder values will have higher fertility rates. This relationship can be seen in Figure 1. This is because fertility rates in each country are influenced by many different factors, both positively and negatively, at different magnitudes.

This paper also hypothesized that the positive effect of SWB on fertility rates would be relatively stronger in developed countries than in undeveloped countries due to socio-economic effects being relatively stronger in deciding to have a child in undeveloped countries rather than in developed countries. Again, the results indicate this to be true, to a certain extent. Throughout the results, notably in Tables 3 & 6, groups formed mostly with developed countries show a significant positive effect of happiness on fertility. However, whilst the magnitude of the coefficient of lifeladder tends to be relatively lower in the groups consisting mainly of undeveloped countries, there is little to no significance. These results may further indicate the true magnitude difference of the effect of happiness on fertility rates between the two groups, especially considering more socio-economic variables tend to be significant in the

regressions with groups formed mainly from undeveloped countries. However, it is still questionable as to why happiness is not significant at all in those regressions, considering the decision to conceive a child is largely a decision of self-fulfilment, in any setting.

The implications of these results are that happiness is possibly a good vehicle in influencing fertility rates in developed countries, but ineffective for undeveloped countries to affect fertility rates through happiness. Moreover, it is also unnecessary for undeveloped countries to actively try to decrease fertility rates, even considering that for some countries the fertility rates are much higher than the replacement rate. High fertility rates are not a problem considering that as countries become more developed their fertility rates will fall, as history has shown with today's developed countries in the past. Thus, undeveloped countries should focus on fostering their socio-economic environment to increase development within the country and fertility rates will fall, as seen in history and in the regressions in this paper where socio-economic variables have significant negative coefficients for groups consisting (mainly) of undeveloped countries.

As for developed countries, the results indicate that socio-economic variables have less importance in the decision to procreate and happiness has an increasing importance as these countries continue to develop. This shows evidence that as countries develop further and socio-economic factors, such as income and job certainty, become more stable, happiness will increasingly be determined by factors of self-fulfilment and will thus be an important variable in the decision to conceive a child. This is important because as mentioned earlier in this paper, using happiness to influence fertility rates is an indirect (pronatalist) policy. Considering that there is opposition from citizens of developed countries to direct government interference with conception choices yet unease with low fertility levels according to Lutz (2007), indirect pronatalist policies are very relevant moving forward. The government can influence happiness through various ways to improve people's lives, which could influence fertility rates even though the citizens would not think fertility rates are being influenced and thus do not feel unease about government intervention with their life choices.

It is surprising to see that happiness is the only indicator that consistently has a positive (and significant) effect on fertility rates throughout all regressions. On the one hand, this shows the importance happiness can play in affecting fertility rates moving forward. On the other hand, there must be more variables that consistently have a positive effect on fertility rates. What is

found in this paper is that many variables have non-linear effects on fertility rates. For example, logGDP per capita has a positive effect on fertility rates in regressions with developed countries but it has a negative effect in regressions with undeveloped countries. This suggests that in developed countries, where socio-economic factors are stable, an increase in GDP per capita increases the safety net of the family and thus having a child is a more attractive option than before. In undeveloped countries however, where socio-economic factors are unstable, adults may choose to stay career orientated in order to have more stable lives. Finding other variables that consistently have a significant and positive effect on fertility rates is beyond the scope of this paper but the results suggest it may be important to find more variables that achieve this, so governments have a variety of options in affecting fertility rates through policy.

Overall, the research of this paper aims to add to the limited research done on the same topic. Furthermore, this paper shows that previous findings on the effect of happiness on fertility rates holds in a global setting. Happiness is a significant factor in affecting fertility rates and moving forward, governments in developed countries should aim to increase subjective well-being in order to maintain fertility rates around the replacement rate.

Limitations

One of the main limitations of this paper is the problem of omitted variable bias. There are many variables that influence the decision to conceive a child which are omitted from regressions due to the feasibility in accessing data. Specifically, an important omitted variable is access to contracapeitves on a national level. A statistic that measures relative access to contraceptives is key in a global fertility study because it is very important to measure the difference in (increased) fertility rates within those countries that have less access to contraceptives. For example, in some undeveloped countries where access to contraceptives tends to be less than in developed countries, the large difference in fertility rates may not be largely due to the economic benefit children may bring in labor but the lack of access to contraceptives, creating an environment where conceiving children is not planned. As far as the author is concerned, the most complete dataset of global access to contraceptives is published by the United Nations Department Economic and Social Affairs (UNDESA) (United Nations, Department of Economic and Social Affairs, Population Division, 2014). Whilst the latest dataset provides detailed information on two different contraceptive prevalence methods

– modern methods (e.g. pill, male/female condom) and traditional methods (e.g. withdrawal) – the dataset is weakly balanced, with many gaps in the time period researched by this paper. Due to this, this study omitted access to contraceptives as a control variable for reliability, although it can be this very likely negatively affected the validity of the results.

Tying into omitted variables, many variables that are omitted affect fertility rates on a personal level rather than on a national level. This brings us to the discussion regarding to what extent is the macroeconomic scope of this paper a limitation itself, considering the decision to have a child is one of the utmost personal decisions a human being can take. National statistics for (log)GDP per capita, unemployment, and female labor can be considered as a good representation of the average single observation of income, whether a person works and whether a woman is working. However, each personal case is vastly different because socio-economic situations are influenced by different personal factors, which directly and indirectly also affect one's decision to have a child. The complexity in trying to dissect the relationship between the many personal factors that affect fertility and fertility itself are what microeconomic studies aim to do. A macroeconomic study cannot dissect these complexities due to its scope, so the question arises to what extent can a macroeconomic study truly find the effects of variables – and importantly, happiness – on fertility when it does not study the deep and personal factors that affect fertility? The likely fall in validity of results due to this is perhaps the main reason past literature has focused on the microeconomic level rather than on the macroeconomic level. However, there are still valuable insights to be gained on the macroeconomic level in possible causations and trends, especially for government policy on fertility rates moving forward in different countries with different socio-economic backgrounds. Though, it could also be counter-argued that finding the complexities in relationships of variables concerning fertility is key for government policy to be successful.

Further Research

This paper suggests that to increase reliability of the model additional variables and most importantly access to contraceptives are added to the regressions. Furthermore, it would be beneficial to replace some variables that very likely affect fertility but are insignificant throughout the paper with other variables in the same field. For example, life expectancy at birth was the indicator used for health in this paper because countries with higher life

expectancies at birth tend to have better health care technologies, access to health care and so on. Seeing as this variable is insignificant throughout the paper, another indicator for health should replace it in the regressions. The same can be done with an indicator for education and female labor participation.

Further research that continues to study such a macroeconomic scope could focus on specific global regions, such as continents or through an indicator that groups countries with close cultural values. This increases the validity of the results as it ensures closer cultural homogeneity within groups, something this paper tries to take account of through country fixed effects. Research in the differences in the effect of happiness on fertility between the male and female gender, something this paper does not focus on at all, can also be studied in these contexts for further findings. This study may need to be done on the microeconomic level, however.

Finally, one could also conduct this research through other measures of happiness. The World Happiness Report collects subjective well-being through the Centril ladder question, but due to the subjective nature of the variable itself, it may be important to study subjective well-being through different methodologies in order to develop a clear picture of the true causal impact subjective well-being has on fertility rates.

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Appendix

Table A1 – Countries included in the dataset

Argentina, Armenia, Australia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Bolivia, Botswana, Brazil, Burkina Faso, Cambodia, Cameroon, Canada, Chad, Chile, China, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Finland, France, Georgia, Germany, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Latvia, Lebanon, Lithuania, Malawi, Malaysia, Mali, Mexico, Moldova, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russia, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovenia, South Africa, South Korea, Spain, Sri Lanka, Sweden, Tajikistan, Tanzania, Thailand, Turkey, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Vietnam, Zambia, Zimbabwe

Table A2 – Countries grouped as Developed or Undeveloped

Developed	**Undeveloped**
Australia, Austria, Belgium, Canada, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Latvia, Lithuania, Netherlands, New Zealand, Poland, Portugal, Romania, Slovenia, Spain, Sweden, United Kingdom, United States	Argentina, Bangladesh, Bolivia, Botswana, Brazil, Burkina Faso, Cambodia, Cameroon, Chad, Chile, China, Colombia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Ghana, Guatemala, Haiti, Honduras, India, Indonesia, Israel, Jordan, Kenya, Kuwait, Lebanon, Malawi, Malaysia, Mali, Mexico, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, South Africa, South Korea, Sri Lanka, Tanzania, Thailand, Turkey, Uganda, United Arab Emirates, Uruguay, Venezuela, Vietnam, Zambia, Zimbabwe

Table A3 – Countries grouped as Happy or Less Happy

Happy (More than 5.31 national happiness average over period analysed)	**Less Happy (Less than 5.31 national happiness average over period analysed)**
Argentina, Australia, Austria, Belarus, Belgium, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Cyprus, Denmark, Ecuador, El Salvador, Estonia, Finland, France, Germany, Greece, Guatemala, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kuwait, Lithuania, Malaysia, Mexico, Moldova, Netherlands, New Zealand, Nicaragua, Panama, Paraguay, Peru, Poland, Russia, Saudi Arabia, Singapore, Slovenia, South Korea, Spain, Sweden, Thailand, Turkey, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Venezuela, Vietnam	Armenia, Azerbaijan, Bangladesh, Botswana, Burkina Faso, Cambodia, Cameroon, Chad, China, Dominican Republic, Egypt, Georgia, Ghana, Haiti, Honduras, Hungary, India, Indonesia, Kenya, Kyrgyzstan, Latvia, Lebanon, Malawi, Mali, Nepal, Niger, Nigeria, Pakistan, Philippines, Portugal, Romania, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Tajikistan, Tanzania, Uganda, Ukraine, Zambia, Zimbabwe

Table A4 – Countries in regions with high child labor rates

Australia, Bangladesh, Botswana, Burkina Faso, Cambodia, Cameroon, Chad, China, Ghana, India, Indonesia, Japan, Kenya, Malawi, Malaysia, Mali, Nepal, New Zealand, Niger, Nigeria, Pakistan, Philippines, Rwanda, Senegal, Sierra Leone, South Africa, South Korea, Sri Lanka, Tanzania, Thailand, Uganda, Vietnam, Zambia, Zimbabwe

Table A5 – Countries grouped as high/low percentage of GDP attributable to agriculture

agriGDP less than 10%	**agriGDP more than 10%**
Argentina, Australia, Austria, Azerbaijan, Belarus, Belgium, Botswana, Brazil, Canada, Chile, China, Colombia, Costa Rica, Cyprus, Denmark, Dominican Republic, Ecuador, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Japan, Jordan, Kazakhstan, Kuwait, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Netherlands, New Zealand, Panama, Peru, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovenia, South Africa, South Korea, Spain, Sweden, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela	Armenia, Bangladesh, Bolivia, Burkina Faso, Cambodia, Cameroon, Chad, Egypt, El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Kenya, Kyrgyzstan, Malawi, Mali, Moldova, Nepal, Nicaragua, Nigeria, Pakistan, Paraguay, Philippines, Rwanda, Senegal, Sierra Leone, Sri Lanka, Tajikistan, Tanzania, Thailand, Uganda, Uzbekistan, Vietnam, Zambia, Zimbabwe