Politics, Culture and Fertility Trends

by

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Dedication

To my parents, whose hard work and determination in the face of adversity has always been and will always remain an inspiration to me.

Preface

This project evolved from a long-running interest in deep socio-political trends. The first encounter with "deep trends" came with reading Fernand Braudel's *Civilisation Matérielle, Economie et Capitalisme, XV^{e}-XVIII^{e}* which sparked an enduring interest in the "longue durée." Behind the fleeting political debates of the moment, are there deep, but detectable, underlying currents that slowly lead our societies in one direction or another, or are dealing with something more akin to the economists' fabled "random walk"? If such long trends exist, what is the relationship between them, contemporary events and the actions of current political leaders? Can one visionary leader take note of them and affect their course, potentially avoiding catastrophe and rejuvenating her nation, or are they truly as inexorable as Marx once thought the coming of the Communist revolution would be? A certain degree of path dependency is unavoidable and perhaps even desirable. However, if a particular society finds that the long-term implications of their current path are unwelcome for whatever reason, what does it take to shift the course of society?

A polis is nothing without its people. So what could be more important than the question of the very survival of peoples, their continued existence across the generations? Indeed, the topic of demographic decline has seen a lot of attention in recent years. The fruits of this attention have been of varying quality, ranging from

the cautious and solid scholarly analysis, to sensationalistic books and articles, unburdened by any evidence or research, and yet proclaiming the imminent end of Western civilization. Yet it is the latter that have found a large and willing audience. That prophecies of doom sell better than sober analysis is hardly surprising. As the early 20th century Jewish-German philosopher Franz Rosenzweig eloquently declares: "Just as every individual must reckon with his eventual death, the peoples of the world foresee their eventual extinction, be it however distant in time. Indeed, the love of the peoples for their own nationhood is sweet and pregnant with the presentiment of death." (Rosenzweig and Galli 2005) And so it is that the advent of sub-replacement fertility in the advanced industrialized world in recent decades, and its subsequent spread to middle-income countries, has been meet with unease wherever it has occurred.

More often than not, politicians have chosen to take action, vowing to end the demographic crisis through various policies and subsidies. Deliberate attempts to change the demographic structure of a country during peacetime are not new, dating back at least as far as the Roman Empire's policy of settling its veterans in the border provinces at the end of their service, possibly one of the decisive factors in the spreading of the Latin language across the empire. The second half of the 20th century has borne witness to many attempts to alter large-scale demographic realities. These have ranged from the tyrannical to the mild. In 1967, Romanian dictator Nicolae Ceauşescu issued a decree banning all forms of birth control, a multidecadal plan to push Romania towards 40 million people by 2000. In the opposite direction of lowering fertility we see India's voluntary sterilization campaigns in the 1970s under

Indira Gandhi, and yet more extreme China's draconic one-child policy and the horrendous stories of forced abortions that followed. Most states have chosen less coercive alternatives, and have mainly taken the form of welfare and tax-credits for children present in many advanced democracies.

Why is a political scientist interested in fertility trends? Is this not something better left to the demographers and sociologists? While I am happy to concede to the demographers the data gathering and descriptive analysis that dominates much of the literature on fertility, I believe that the political implications of even small differences in fertility, when compounded across decades, are stunning in the breadth of political implications. While sociologists might discuss the deep cultural roots and social effects of changing fertility patterns, I am more interested in the contexts in which population policies are effective or not. Why do child subsidies work in some countries but not in others? Moreover, the great fiscal debates that dominate discourse on both sides of the Atlantic in the early years of the second decade of the 21st century are firmly rooted in demographic causes. Simply put, for decades, European women in many countries have had fewer children than would have been needed to support prevailing levels of entitlements. The aging population of post-war baby boomers is understandably reluctant to vote towards slashing its own pensions and delaying its own retirement. Similarly, while beyond the scope of the current work, the hot button topic of immigration and the accompanying fears of demographic replacement are also much more clearly understood through the demographic lens.

A majority of the work scholars have done in the field of demography, even when specifically discussing political consequences, is at the level of a single country,

and otherwise over a limited time horizon. By contrast, the data used for this work span a large number of countries across three decades. Demography is destiny, or so goes the bon mot, and there is a great deal of truth to that. In this work, I will try to show that it is not entirely a one-way street. Demographic trends are slow and "sticky," it is true. However, they do not escape entirely from the orbit of politics, but instead both transient and stable political events affect demographic outcomes in deep and meaningful ways. This work will be an exploration of this relationship.

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ABSTRACT

Total fertility rates have been falling across the world, with a majority of the world's countries and population now below generational replacement rate. Contrary to the initial assumption that women are merely delaying child-birth, in some advanced industrial countries the sub-replacement fertility trend has persisted for decades, indicating permanently lowered fertility expectations. This study looks at the differences and similarities between low fertility countries and those who have bounced back towards replacement levels. I use micro-level data from the World Values Survey to assess cultural shifts that relate to individual-level fertility decisions, as well as macro-level data to evaluate country-level conditions and, when either direct or indirect pro-natalist policies are in place, policy effectiveness. The results show a combination of cultural change and either family-friendly labor market norms or government intervention can indeed lead to a sustained rise in total fertility. However, other cultural, historical and political factors might delay or prevent policy adjustment.

Chapter 1

Introduction

Research Topic

Joseph Rudyard Kipling is nowadays mostly remembered for his children's tale *The Jungle Book* (Kipling 1897). Yet at the start of the 20th century he was better known for his poems, interpreted then as praising British imperialism at a time when maps showed a quarter of the world's land mass painted reddish pink with the colors of Britain, the largest empire in all history. None but himself can say what the author's intent was, of course, and yet a tone of chastisement against the sin of hubris pervades the man's work: "Our pomp of yesterday/ Is one with Nineveh and Tyre," he writes in the *Recessional*, referring to the ruins of powerful cities from biblical times. After the First World War, which claimed the life of his only son, his tone becomes darker still. In his 1919 poem, *The Gods of the Copybook Headings* (Beecroft 1956), he issues a dire warning:

> "On the first Feminian Sandstones we were promised the Fuller Life
> (Which started by loving our neighbour and ended by loving his wife)
> Till our women had no more children and the men lost reason and faith,
> And the Gods of the Copybook Headings said: "The Wages of Sin is Death."

These four lines together summarize rather well the topic of this dissertation. The first alludes to female emancipation and to the quest for self-fulfillment and self-expression that has become one of the driving forces of modernity. The second

foreshadows what came to be known half a century later as the sexual liberation movement, an earthquake that changed family and social dynamics fundamentally in the past half-century, with no way (and likely no desire) to go back to the status-quo-ante. The third line predicts the persistent decline in fertility rates across the globe; and finally, the last line hints at the potential threat the abovementioned fertility trend seems to pose to the continuation of the very civilization that gave rise to these changes.

This work, then, is to be an academic encounter with the issues surrounding changing fertility rates, with a particular focus on the advanced industrial democracies that are spearheading this change. ***Why, despite similar levels of development and at least superficially similar policies, have some nations been stuck for decades with very low fertility while others are at or near population replacement levels? Why, for instance, does pro-family spending seem to boost fertility rates only in some instances and not in others?***

Declining fertility around the world suggests that other countries are following the path of the advanced industrial states. Therefore, gaining a better understanding of the determinants of fertility will allow us to predict demographic trends in the developing world more accurately. For instance, would China's fertility rebound if the government were to abolish the one child policy tomorrow? More generally, why does pro-family spending seem to produce results in some countries but not in others?

Northern Europe and many of the Anglophone countries are anomalous compared to other members of the Organization for Economic Cooperation and Development (OECD), a club of relatively rich and relatively free countries. After a bout of low fertility in the 1980s and 1990s, the former have climbed back to levels

approaching and in some cases even exceeding replacement levels. Meanwhile, the rest of the OECD members (and many poorer countries) have remained at the previous low levels, or plunged even deeper into what demographers now call lowest of the low fertility rates. The phenomenon of rising fertility is restricted to a mere handful of countries and relatively new, as scholars have taken note of it after the turn of the new millennium. What is the cause of this dramatic divergence? Does it go back to some fundamental cultural difference that we can trace back centuries, as Putnam does in his famous analysis of the differences between Northern and Southern Italy? (Putnam, Leonardi et al. 1994) If so, we would have to resign ourselves to watch the slow and inexorable march of demography, some nations perhaps tragically doomed by their very culture diminish into dust. It would be the stuff of Greek plays: the prosperity of the parents coming at the expense of the grandchildren. It is undeniable that modernization has spread like wildfire and is set to engulf the entire world within a few short decades. Fertility decline follows wherever modernization touches (UN Secretariat 2009). If the drivers behind this change are indeed as glacially slow moving as social trust in Putnam's analysis of Italy, one can only shudder to think what a grim fate awaits much of the world, as populations freed from subsistence and empowered with reproductive control, choose not to engage in inter-generational replacement, effectively breeding themselves out of existence in slow-motion. Economic and social change in the past was more gradual, with 3% annual growth rates considered exceptional, perhaps even perilously high back in the 19th century, and yet so many now developed countries are still struggling to adapt. With plenty of developing countries now growing at rates in excess of 9% per year, this much faster current pace of economic and social change is likely to

wreak havoc upon their cultures and societies, with so little time to adapt and prepare to deal with the pitfalls of modernity.

Some aspects of culture are faster to adapt than in Putnam's civic participation example. We have substantial survey evidence that at least some deeper level values are changing (Inglehart 1997). Perhaps norms relating to fertility are fast changing as well, and if so, then the rest of OECD can hope to join the Northern Europeans and the Anglophone countries sooner rather than later, and see their cultures preserved and enhanced by modernity, rather than extinguished. I seek to explore this hypothesis. In Chapter 2, I discuss how issues of differential fertility have shaped the world and have inflamed politics. In Chapter 3, I present an overview of three types of variables used to explain fertility: socio-economic indicators, government policies and cultural values. In Chapter 4, using two World Value Survey dimensions, I show cultural variables to be strong predictors of fertility levels within the OECD dataset, even when controlling for a host of other variables, including fixed country effects. Chapter 5 draws a conclusion from these findings and illustrates future research topics that arise from my findings. However, before I can begin my analysis, a brief overview of issues related to demography is perhaps necessary in order to familiarize the reader with some core concepts that I will use from here on.

Measuring the Dependant Variable: Defining Fertility

I am interested in cohort replacement across generations, in other words, whether the parents in a specific age cohort have enough children to maintain or increase that population across generations, given a specific mortality rate. The simplest way to measure fertility is to count the number of children born. One potential measure for this is the crude birth rate, the number of children born per thousand women per year. However, using this measure of fertility would make comparisons between countries problematic, because different countries have different age structures and cohorts often are of unequal size, especially in the immediate aftermath of a fertility transition baby boom (see discussion below). As we know, women do not have children uniformly at all ages, and this means that using crude birth rates would distort the data. Alternatively, cross-country patterns of childbearing can be measured by both cohort and period indicators. Cohort indicators such as the completed fertility rate (CFR) assess the birth rate of women born in a given year as they attain the end of their reproductive cycle. These have the obvious disadvantage of only being able to give us an indicator for women exiting their reproductive cycle, leaving us in the dark with regards to more recent changes in fertility behavior. Moreover, with assisted reproductive technology, more and more women are having children later, bringing into question any methodology that uses a rigid age cut-off for completed-fertility.

For these reasons, the core variable that I will be using instead throughout this dissertation is the **total fertility rate** (TFR). The total fertility rate in a specific year is the number of children that would be born to each woman if she were to live to the end of her

childbearing years and if the likelihood of her giving birth to children at each age was the currently prevailing age-specific fertility rates (UN Secretariat 2009). It is generally computed by summing up the age-specific fertility rates defined over five-year birth-cohorts. Assuming there are no migration flows and that mortality rates remain unchanged, a total fertility rate of 2.1 children per woman generates broad stability of the population: it is also referred to as the "replacement fertility rate" as it ensures replacement of the woman and her partner with another 0.1 "children" to counteract infant mortality. The figure might actually be higher for other countries with higher infant mortality rates (Espenshade, Guzman et al. 2003), but 2.1 is reflective of the replacement fertility rate for OECD members and other developed nations which are the focus of this dissertation. At fertility levels below 1.7 I will be talking about "low fertility" and at levels below 1.4 about "lowest of the low fertility" (Kohler, Billari et al. 2002; Billari and Kohler 2004).

Two new explanatory variables

One of the problems of the current literature on the determinants of fertility is the lack of an effective means of quantifying the otherwise intangible cultural aspects of fertility. There are numerous high-quality econometric analyses (Rosenzweig and Evenson 1977; Lillard 1993; Ehrlich and Kim 2007; Michaud and Tatsiramos 2008; Booth and Kee 2009; Day and Dowrick 2010). Caldwell (1976; 1987; 1990) and others (Greenhalgh 1995; Fernandez and Fogli 2005) have performed numerous careful analyses

of the cross-societal and intergenerational cultural aspects of fertility. Hakim's work on preference theory (Hakim 2000) is an impressive blend of anthropological and econometric, but as a rule, as Sorkin noted decades ago, the amount of communication between sociologists and econometricians is very small (Lesthaeghe and Surkyn 1988), with econometricians often making heroic assumptions about values, preferences and tastes, and sociologists ignoring powerful secular trends to pursue niche theories.

I propose to use an aggregate set of measures generated from the 6 waves of the World Values Survey (WVS) project as consistent markers for national-level cultural traits. I am referring to Inglehart's (1997) two cultural value dimensions. J. Feyrer et al. make use of World Values Survey data to assess fathers' readiness to assist in household chores related to childcare (Feyrer, Sacerdote et al. 2007), but they do not use any broader cultural measure, and even then they make only partial use of the dataset by separating the 2000 wave of the WVS. While that is a perfectly legitimate use of the dataset for a static estimation, a study of fertility dynamics can gain a lot more from using a time series dataset, since time series will render within-country and cross-regional patterns across time visible in a way that is simply not possible with a one-year snapshot. Moreover, since the divergence in TFR has gathered pace in recent years, having the most up-to-date survey coverage is essential. I was able to make use of matching questions from the recently released 2008-2009 European Values Study to augment the WVS dataset, as well as incoming data from the latest ongoing wave of the WVS (2011-12). This analysis has the advantage that it can make use of new data, in terms of recent demographic variables but most importantly in respect to new cross-national survey-data.

In *Exploring the Unknown,* R. Inglehart and C. Welzel have shown that a set of macro-level predictors derived from analysis of WVS survey data are capable of accurately estimating the aggregate responses in subsequent surveys, even in countries not previously surveyed (Inglehart and Welzel 2005). If these two quantifiable measures of culture move in predictable ways and are indeed connected to fertility rates, then similar cultural estimators can improve the accuracy of future econometric models of fertility.

	Factor Loadings			
Dimension and Item	Nation Level		Individual Level	
Traditional vs. Secular-Rational Values[a]				
TRADITIONAL VALUES EMPHASIZE THE FOLLOWING:				
God is very important in respondent's life.	.91	—	.70	—
It is more important for a child to learn obedience and religious faith than independence and determination.[b]	.89	—	.61	—
Abortion is never justifiable.	.82	—	.61	—
Respondent has strong sense of national pride.	.82	—	.60	—
Respondent favors more respect for authority.	.72	—	.51	—
(SECULAR-RATIONAL VALUES EMPHASIZE THE OPPOSITE)				
Survival vs. Self-Expression Values[c]				
SURVIVAL VALUES EMPHASIZE THE FOLLOWING:				
Respondent gives priority to economic and physical security over self-expression and quality-of-life.[d]	—	.86	—	.59
Respondent describes self as not very happy.	—	.81	—	.58
Respondent has not signed and would not sign a petition.	—	.80	—	.59
Homosexuality is never justifiable.	—	.78	—	.54
You have to be very careful about trusting people.	—	.56	—	.44
(SELF-EXPRESSION VALUES EMPHASIZE THE OPPOSITE)				

Table 1.1: Components of the two cultural dimensions in Inglehart's analysis. From Inglehart 2000.

The two cultural dimensions previously identified by Inglehart (1997; 2000) are the Traditional/Secular-Rational dimension and the Survival/Self-Expression dimension. The survey questions they derive from and their relative factor loadings are indicated in Table 1.1 above.

The Traditional/Secular dimension is indicative of a person's views on religion and traditional values, such as respect for authority, opposition to abortion, national pride and the importance of obedience and hard work. Negative scores on this dimension indicate a more traditional person, while positive score indicate an orientation towards the rational-secular end of the spectrum.

The Survival/Self-Expression axis is also a composite of several questions. First, whether the respondent's concern about his physical security leads him to prioritize that and economic security above self-expression and personal wellbeing, a measure of happiness, willingness to take political action, attitudes towards sexual minorities, and levels of trust. Negative values on the Survival/Self-expression dimension indicate a person more focused on survival whereas positive values indicate an orientation towards self-expression.

The idea of using national aggregates of these measures is not entirely new. Inglehart and Norris (2004) discuss the negative relationship between religious values and fertility rates. In this context, using WVS data from the mid-1990s wave, they produce a snapshot graphic showing a negative relationship between high Traditional/Secular-Rational values and fertility rates. Traditional/Rational encode a set of values associated with attitudes towards religiosity. Previous work has shown that a population exhibiting high levels of religious belief (Mosher, Williams et al. 1992) and praxis (Skirbekk, Kaufmann et al. 2010) tends to exhibit higher fertility, and several of the largest religions actively encourage large families, discourage contraception and strongly oppose abortion. Using the WVS data from 1981-1995, Inglehart and Norris

show that the Traditional/Rational-fertility rate relationship holds even when controlling for the level of economic development (Inglehart and Norris 2004, 232-239).

Topic Relevance

There are large cross national differences in fertility between the highest fertility country (currently Niger, with a 2010 TFR of 7.0) and the lowest (Hong Kong, whose TFR is now 1.0). However, the socio-political implications of even small differences in fertility, when compounded across decades, are stunning. If Italy were to maintain the TFR it had in 2002 (1.3) for 45 years, given its current age structure, its population would decline by 50%, (Harris 2006, 48) a level of population loss not even matched by the Black Death in the 14th century (Gottfried 1985). While prima-facie, such a prolonged period of low fertility might seem unlikely, it bears keeping in mind that the last time Germany has seen a fertility level above 1.5 was in 1975. In Germany, this 35 year window is sufficient to reject assumptions that the lower TFRs might simply reflect delayed fertility, since the period is long enough for at least one cohort to go through its entire reproductive life to completed fertility. Even with generous assumptions about birth postponement (Sobotka 2004), the fertility rates remain far below replacement. Bloom et al (2009) reach similar conclusions: "Without substantial adjustments in labor force participation or migration policies, the potential negative repercussions on the European economy are large."

In 2009, there were 74 countries that had fertility rates below replacement, and 37 below 1.6 births per woman. The governments of each of these 37 countries have reported to the United Nations that they consider this rate “too low” (See Appendix). When fertility is below replacement level only by a small amount, the size of following generations falls only gradually and, if considered necessary, there is ample opportunity to supplement the generation size with migration. When fertility remains very low, however, the generation size falls rapidly and only massive immigration can offset the decline (United Nations 2000). There is evidence also that very low fertility, on average, is counter to the preferences of individuals experiencing it (D'Addio 2005).

German workers were recently outraged when their government decided to help bail out fellow EU member state Greece, whose budgetary deficits were so large that default seemed likely. Among the main causes of the Greek deficit are the mandatory expenses of the state pension fund. Part of this has to do with irresponsible policies. While in Germany the retirement age is 67, in many a case a Greek would be able to retire at a mere 55. Moreover, while in Germany the median worker can expect his pension to be about 60% of his working wage, for Greece, the median worker's pension would be an unbelievable 110% of the net median wage. (OECD data). But the fundamental causes go far deeper than a few short-sighted politicians. Figure 1.1 below shows Greece's population pyramid. Its thinning base once temporarily lowered the youth dependency ratio, in what demographers call a demographic window - it was by taking advantage of this window that countries like Taiwan and Korea blossomed into wealth. However, for Greece, the window is now slamming back closed, threatening to shatter the window-frame and let in the cold winter air — Greece's long term demographic

prospects are grim indeed. Greece's long-time rival across the Aegean, Turkey, already outnumbered them in population 3:1 in 1950, sporting 21 million citizens to Greece's then 7.6 million. In 2100, under a UN projection (Secretariat 2011), Turkey might have as many as 116 million citizens, while Greece will have diminished back to the 1950s level with 7.7 million mostly elderly citizens, a ratio of 15:1 even before we look at military manpower. But Greeks today would be hard-pressed to spend too much time pondering military concerns about the situation 90 years on, being more preoccupied with the specter of imminent bankruptcy and difficulties paying the pensions and wages of public employees. The German politicians and other Europeans eventually decided to help, with full knowledge that they might have to do so repeatedly in the future. Unsurprisingly, the political costs to the German chancellor and her allies were large. Yet this is only the beginning of the crisis for much of Europe. While its cross-national nature exacerbated the German tax-payers' outrage, even larger distributional conflicts are simmering domestically: between the old about to retire and the underemployed young who do not relish the idea of paying much higher taxes to pay for it all.

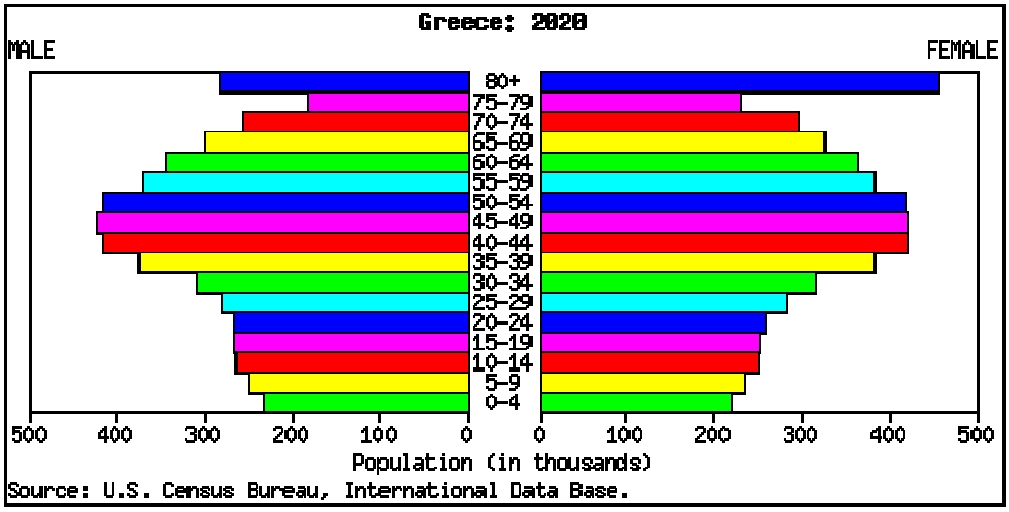


Figure 1.1: Greek Population Pyramid for 2020

The great fiscal debates that dominate discourse on both sides of the Atlantic in the early years of the second decade of the 21st century are firmly rooted in demographic causes. Fiscally, the problem is that fundamentally, many of the social protection programs were set up with the structure of Ponzi schemes - pay as you go funds that could stay above water if and only if the populations paying into them continued to grow. Instead, for decades now, European women in many countries have had fewer children than would have been needed to even replace the current generation, never mind support prevailing levels of entitlements in the context of lengthening life-expectancies. The large and aging population of post-war baby boomers is understandably reluctant to vote towards slashing its own pensions and delaying its own retirement, making reform difficult. Similarly, while beyond the scope of the current work, the hot button topic of immigration and the accompanying fears of demographic replacement are also much more clearly understood through the demographic lens.

Chapter 2

Demographic Overview

Population and Fertility

In the Hebrew Bible, after drowning the entirety of humankind aside from the patriarch Noah and his family in a massive flood, God instructs the survivors to be fruitful and multiply upon the earth. While that is a mythical account, the scientific evidence does in fact suggest that about 73,000 years ago, the human race almost went extinct. A recent analysis of mitochondrial DNA evidence indicates that at that time the entire human population was reduced to under 15,000 individuals, perhaps as low as 2,000 (Williams 2011). The cause appears to have been not flood but fire: by far the largest volcanic event in over 2 million years, the massive Mount Toba eruption plunged the Earth into a long period of severe climatic disruption (Jones 2010). From this almost Noahide start, it took humanity 73,000 years to reach a population of 1 billion, an average annual growth rate of 0.00018% – a near stasis. Reverend Thomas Malthus, one of the grandfathers of demography, famously wrote that human capacity for population growth was exponential, and would necessarily outpace the resources available to them at any given time, which he assumed would grow at a linear pace. Humans were therefore

doomed to live on the edge of subsistence. Insufficient harvests would lead to famine, plague and war, keeping human populations from growing faster than food supplies (Malthus 1798). For thousands of years the laws of Malthus seemed to apply in their full cruelty, and a plethora of diseases and calamities took their awful toll, ravaging the ranks of both newborns and adults, keeping human populations in check. Growth was slow. Then something happened. After topping 1 billion as late as 1804, humankind reached the second billion mark a mere 123 years later, in 1927. Growth seemed only to accelerate from there: 3 billion in 1960, 4 billion in 1974, 5 billion in 1987, 6 billion in 1999, and 7 billion toward the end of 2011.

Earth Population Change, billions	*Years required to gain another billion*		
	Low	*Medium*	*High*
0-1		73,000	
1-2		123	
2-3		33	
3-4		14	
4-5		13	
5-6		12	
6-7		12	
7-8 (projection)	*24*	*14*	*10*
8-9 (projection)	*∞*	*18*	*11*
9-10 (projection)	*∞*	*41*	*11*

Table 2.1. Time to Increase by 1 billion. Source: UN estimates, Low, Medium and High Projections

Looking below at Figure 2.1 and Figure 2.2, we can see the current countries of the world with their surface areas distorted by the estimated relative population in their respective territories in the given year. Countries that account for a lot of the Earth's population compared to their area will be larger than they would be on a normal map, while under-populated countries are smaller than they would otherwise be. We can see that in both figures Australia and Canada are almost invisible, because they have a vast

area and a very small population, while India and Bangladesh's burgeoning populations make the countries larger than they would be on a standard map.

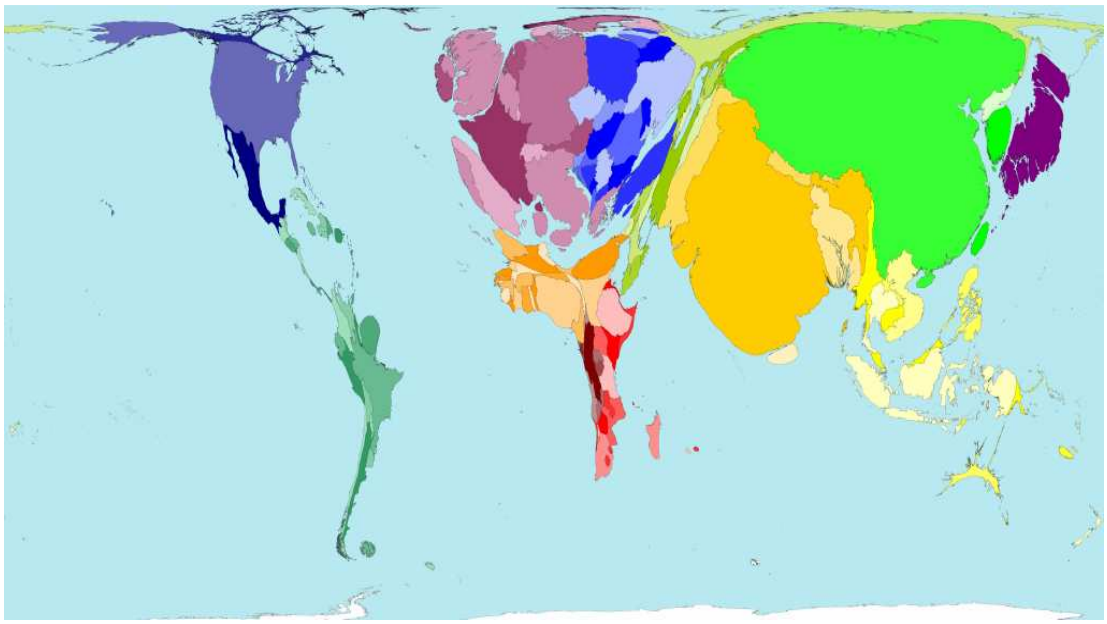


Figure 2.1. The Map of the World, with countries distorted according to population, 1900. UN estimates.

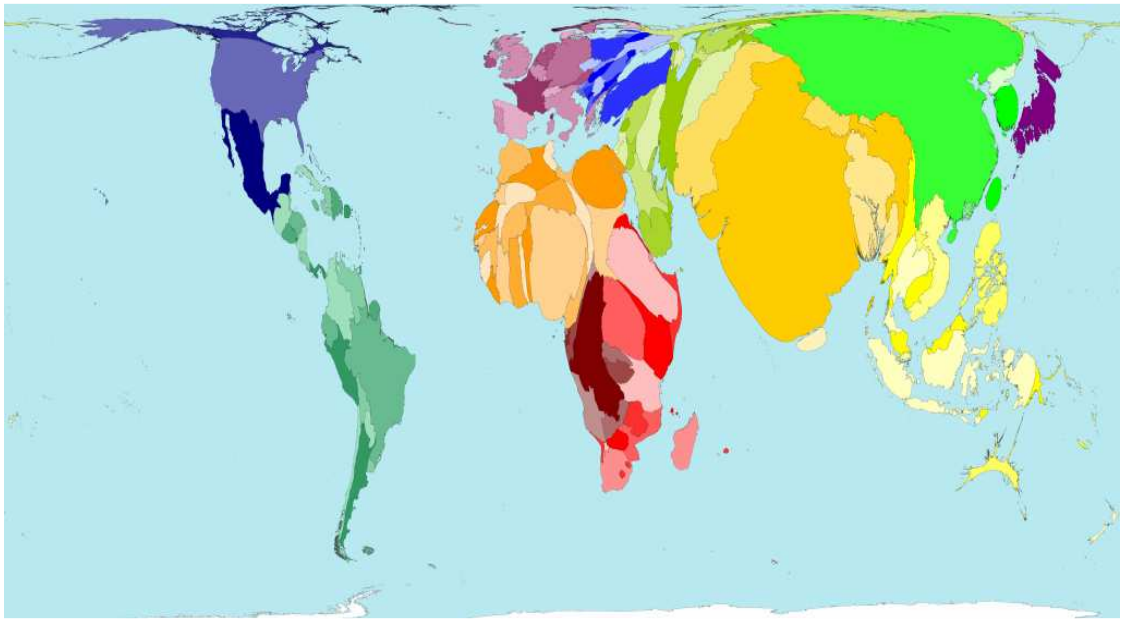


Figure 2.2. The Map of the World, with countries distorted according to population. Projected, 2050. UN

Now, comparing the first map, the world's population in 1900, with the projection for 2050 we can see that the growth in the world's population has not been (and is not expected to be) uniform across time and space. Instead, the dramatic growth started in Europe, with the advent of the complex set of technological, social, political and economic changes we have come to refer to as the Industrial Revolution (Caldwell 2008). Looking at the image of the bulging European continent set astride a thinly populated Africa, we can perhaps have a clearer sense of how in 1900 the people of Europe represented 25% of the world's population, which was the highest share of the world's population ever attained by Europe (Maddison 1997). In 1900, there were more people in Europe than on all the continents but Asia taken together! Seen in this context, it is a tempting oversimplification to look at the outward European migrant flow and colonial expansion in the 19th century as if it were as inevitable as a gas law. However, the flow soon reversed its direction: as the means of increasing food yields and decreasing child mortality slowly spread across the world, the rest of the world's population started increasing rapidly.

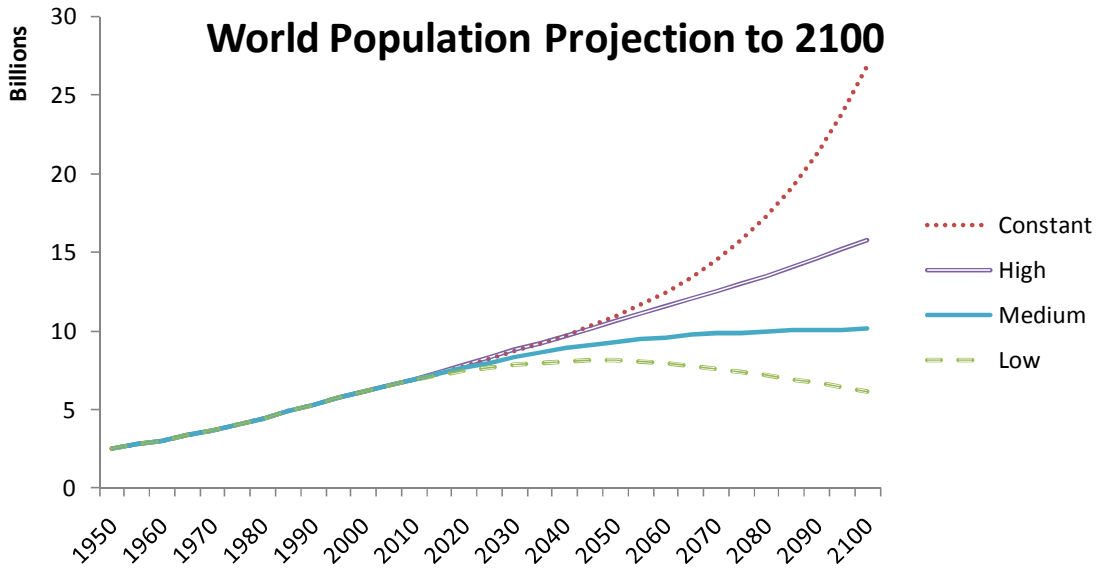


Figure 2.3. Population Projections given four sets of assumptions. UN.

By 2050, Europe's share of the world's population will have fallen far below its long-term historical average of 20% (as seen in Table 2.2 below) to an astonishing 7%. For the 1999-2050 interval the UN prognosis has Africa gaining another billion inhabitants, while Europe is set to diminish by over 100 million. If the UN predictions are accurate, Africa will have roughly three times as many people as Europe: an astonishing transformation.

Major area	*1750*	*1800*	*1850*	*1900*	*1950*	*1999*	*2050*
			A. Population size (millions)				
World	791	978	1 262	1 650	2 521	5 978	8 909
Africa	106	107	111	133	221	767	1 766
Asia	502	635	809	947	1 402	3 634	5 268
Europe	163	203	276	408	547	729	628
Latin America and the Caribbean	16	24	38	74	167	511	809
Northern America	2	7	26	82	172	307	392
Oceania	2	2	2	6	13	30	46
			B. Percentage distribution				
World	100	100	100	100	100	100	100
Africa	13.4	10.9	8.8	8.1	8.8	12.8	19.8
Asia	63.5	64.9	64.1	57.4	55.6	60.8	59.1
Europe	20.6	20.8	21.9	24.7	21.7	12.2	7.0
Latin America and the Caribbean	2.0	2.5	3.0	4.5	6.6	8.5	9.1
Northern America	0.3	0.7	2.1	5.0	6.8	5.1	4.4
Oceania	0.3	0.2	0.2	0.4	0.5	0.5	0.5

Source: United Nations Population Division.

Table 2.2: World Population Estimates, UN

There is yet another way to illustrate just how unique our current circumstances are in history. The chart below, *Figure 2.4*, is based on estimates from Angus Maddison, and it shows that over 25% of all person-years ever lived took place in the 20th century. The last century was also responsible for 55% of all the GDP humankind ever generated, and since then, during the first 10 years of the 21st century, we produced 23% of all the GDP ever created (Maddison 1997, 2010 data update by Economist).

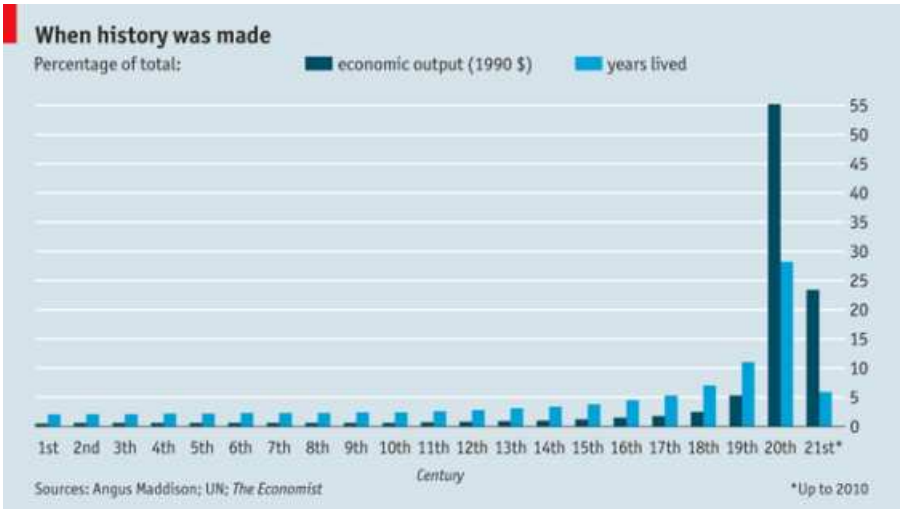


Figure 2.4: A quarter of all the people who ever lived were alive in the 20th century. The Economist.

Behind all these changes in population lie shifting total fertility rates, combined with dramatic decreases in infant mortality rates. There are numerous theories on Fertility Transition in the literature (see the review by Caldwell 2008). The most widespread is the standard economic-rational model, which assumes that in societies of every type and stage of development, fertility behavior is rational, and fertility is high or low as a result of economic benefit to individuals, couples or families in its being so. Caldwell (1976) suggests that the direction of the intergenerational wealth flow is one of the main determinants of high or low fertility. Lesthaeghe argued that there have been two distinct fertility transitions, one post-agricultural and one post-industrial (Lesthaeghe and van de Kaa 1986), arriving in five distinct chronological stages:

1. *High mortality high fertility phase*, characteristic of rural agricultural societies living on the edge of subsistence. Children are raised frugally and expected to

contribute from an early age. Population is at a relatively stable, relatively low level.

2. In the *decreased mortality, high fertility phase,* due to improvements in personal hygiene, better food safety, cleaner water supply and (more recently) advanced medicine, death rates drop precipitously. Birth rates remain high, resulting in a population explosion. Caldwell and others argue that the length of time a society will remain in stage 2 has to do with how fast the costs of children are rising, turning them from a purely economic perspective, from net assets into net liabilities (Caldwell 1982, 201). As long as children can produce a net income with low investment, people will have more of them. (Becker and Lewis 1974) Twopeny's account of Australian life around 1880 shows that children were certainly not pampered:

> "A description of the home of a carpenter around 1880 makes the point that he was well-housed compared with his fellow tradesmen who did not immigrate from Britain, but goes on to describe the house as containing, in addition to the kitchen, a room shared by the two youngest children, the carpenter and his wife, and an adjacent small room for the four other children. Children rarely saw doctors or dentists". (Twopeny 1973, 46)

3. *Decreased mortality, decreasing fertility phase*. This is the first stage of fertility decline. Fertility in Europe and its offshoots started declining even before the advent of modern contraception, which may be interpreted as a rational response to rising costs of parenthood (Caldwell 1976; Hureaux 2000). In Caldwell's thorough analysis of Australia and Britain in the late 19th century, it was the delayed onset of marriage that was the primary driver of this reduction (Caldwell 1982, 185) as men and women were expected to be able to afford their own household prior to marriage. As the use of birth control becomes culturally

acceptable and reliable, and as women become more educated and start entering the labor force, the prevalence of birth control increases, dramatically reducing fertility. At this point, the first fertility transition is ongoing.

4. *Low mortality, low fertility phase*. According to the standard theory (as it stood in the mid-1980s), at this stage mortality and fertility have reached a new equilibrium, and population is stable. People have few children and invest in them heavily.
5. *Low mortality, below replacement fertility phase.* There was no theoretical ground on which the idea that birth rates and death rates would actually reach equilibrium at replacement. In stage 5 countries, TFR has actually fallen substantially below replacement levels. This would be the inevitable second fertility transition phase, if the dual transition model is correct. This would imply global population decline once all countries reach this level.

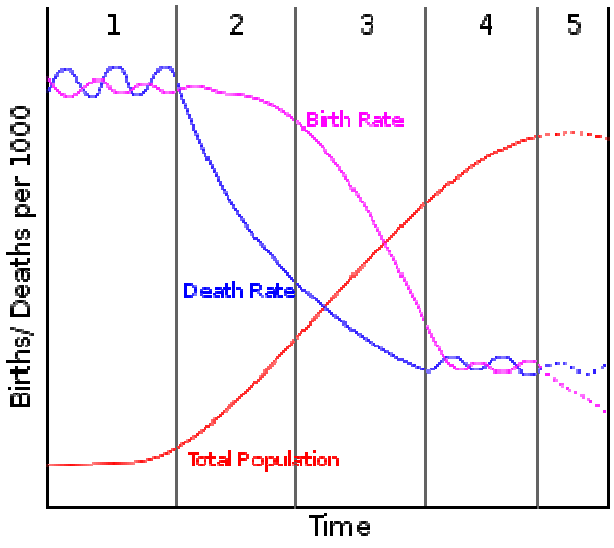


Figure 2.5: A simplified model of the Fertility Transition Theory.

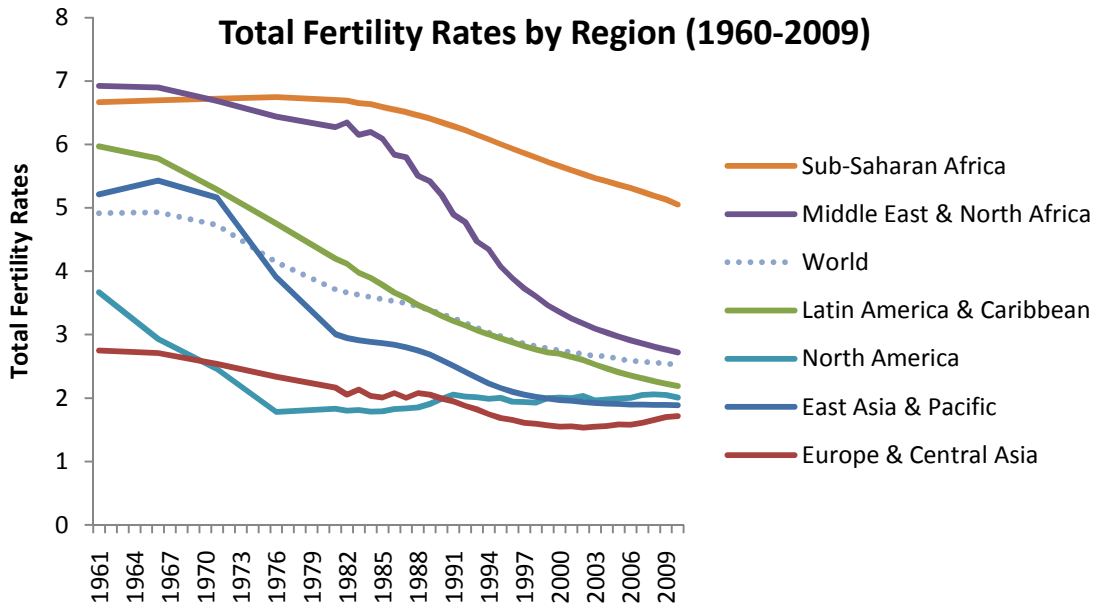


Figure 2.6: Total Fertility Rates by Region. Only the Middle East and Sub-Saharan Africa remain significantly above replacement.

The world seems well on its way towards these transitions. As can be seen in Figure 2.6, with the notable exception of a handful of countries in sub-Saharan Africa that have remained mostly rural and agricultural, total fertility rates have been decreasing across the world. By 2012, many of the industrialized countries in the OECD would be entering their fourth decade of below replacement fertility rates, and many still developing countries will have dipped below replacement as well. This development was not anticipated. Instead, demographers were expecting only continued relentless growth.

Demography as a Political Issue

It was only a few decades ago that demographers and laymen fretted about the crisis of overpopulation, and not just in distant places overseas, but at home too. In Richard Fleischer's 1973 classic *Soylent Green*¸ a science fiction film starring Charlton

Heston as a detective in the year 2022, the director depicted a desert-like, overpopulated and impoverished United States where things had gotten so desperate that the population survived on soylent green, a substance produced from the industrially-processed remains of the dead (Fleischer and Heston 1973). Judging by the tone of books and papers[1] on the topic of population that were being published at the time, Fleischer almost comes across as an optimist. P.R. Ehrlich's very influential *Population Bomb* (1968) famously (and erroneously) predicted world-wide resource depletion, starvation and the inevitable death of hundreds of millions in "famines of unbelievable proportions" before 1975. Ehrlich received a MacArthur Foundation Genius award for his work. According to the narrative, more people were bad for the planet, almost like a terminal cancer:

> "There is an alarming parallel between the growth of a cancer in the body of an organism and the growth of human population in the earth's ecological economy. ... Cancerous growths demand food; but so far as I know, they have never been cured by getting it. The analogies can be found on our plundered planet. [...] How nearly the slums of our great cities resemble the necrosis of tumors raises the whimsical query: Which is the more offensive to decency and beauty, slums or the fetid detritus of a growing tumor?" (Gregg 1955)

Moved by this spirit of doom, in 1980 the same Dr. Ehrlich had confidently made a bet on the prices of five metals in 1990 against the famous economist Julian R. Simon, convinced that explosive population growth would drive the prices relentlessly upward (Tierney 1990). Ehrlich turned out to have been wrong on all five metals, just as his predictions of doom from the *Population Bomb* never came to pass. Nonetheless, he remained an influential and respected figure. Indeed, there are still neo-Malthusians who

[1] For a very comprehensive discussion of the dark Eugenic past of the birth control movement, see Fred Pearce's "The Coming Population Crash and Our Planet's Surprising Future, pp 33-87. I will skip the inter-war period and Nazi era in this review.

claim that crisis and mass starvation was averted only temporarily, due to the unexpected advent of the green revolution, but in fact overpopulation is still an ominous looming global threat (Hartmann 2009).

The doom scenarios generated vigorous political support in the West in favor of promoting birth control at home and abroad. In India, Indira Gandhi initiated a policy of voluntary vasectomy. The government would pay its citizens the equivalent of $6 to undertake the vasectomy, and during the terrible famine of 1967, many did. It didn't seem to decrease fertility fast enough, so after assuming emergency powers in 1975, Mrs. Gandhi's New Population Policy stated that "where [an Indian] state legislature, in the exercise of its own powers, decides that the time is right and it is necessary to pass legislation for compulsory sterilization, it may do so." Eventually, the policy would cost her the election. (Pearce 2010, 64) In China, with no elections to contend with, the Communist Party instituted a one-child policy in 1978, resulting in forced abortions, increased female infanticide, and an estimated 400 million fewer Chinese (Skalla 2004), all because of calculations based on demographic projections. Millions of dollars in funding from Western donors and governments continued to flow, and birth control spread into the developing world rapidly decreasing family sizes, just as the Green Revolution spearheaded by Dr. Norman Borlaug's research teams dramatically boosted agricultural yields.

Ironically, 1973 –the year *Soylent Green* came out– was also the first post-Depression year when the US experienced sub-replacement fertility, and the US would not reach replacement level again until 2007, although its population continued growing throughout thanks to reduced mortality rates and continued high immigration. The sense

of urgent population crisis at home and abroad only slowly abated, and to some extent still pervades public culture.

By the late 1990s, writing about the dangers of overpopulation had decidedly gone out of fashion and instead the opposite fear emerged among trendy academic types. "Is modernity against life?" asked Roland Hureaux, French political scientist and journalist, in his book *Le temps des derniers hommes* (2000). After an overview of the European population attrition due to low birth rates, examining fertility decline starting in 18th century France and continuing to the present day, and subjecting the standard models of fertility to a withering critique, Hureaux answers his own question in the positive. He concludes that "confronted with the most basic of choices, that between to be and not to be, our society, insidiously, appears to have chosen not to be" (Hureaux, 286). P. Longman, in *The Empty Cradle,* fears that falling birthrates "threaten world prosperity" (2004). While economists warn that declining populations will require large-scale immigration to keep the economy running and the pension funds afloat, some use the demographic figures to argue against immigration. In *Eurabia: The Euro-Arab Axis,* Bat Ye'or argues, in a rather acerbic and combative tone, that cultural loss of confidence brought about by declining native population will lead Europeans into "dhimmitude" and an eventual takeover of Europe by North African and Middle Eastern immigrants (Ye or 2005). Although demographers have pointed out that in terms of population dynamics such a scenario is very unlikely, some have been more receptive. Niall Ferguson, a Harvard professor, called her claims "credible." (Ferguson 2004) Fellow historian and Middle East expert Bernard Lewis agreed: "Europe will be Islamic by the end of the century." (Caldwell 2004). Others are not so concerned with immigration but more

pragmatically ask: "Who will do the work? Who will pay the taxes?" (Harris 2006). L.J. Kotilkoff warns that if the present demographic trends don't improve "our kids will face lifetime net taxes twice the rate that those we face" (Kotlikoff and Burns 2005).

Considering how the dire predictions of the overpopulation scare literature have been spectacularly wrong, it is tempting to discount the underpopulation worries as just more of the same. We have seen that alarmist books attract more attention and probably sell better too. Nonetheless, could it be that far-below replacement fertility is here to stay? Two observations argue against this conclusion. First, the decline was never a universal characteristic of developed countries. Several western countries have never dipped far below replacement rate. The United States briefly probed the 1.7 level in the late 70s, during the Carter years, but has maintained a steady course around 2.0 ever since the early 90s. Uniquely among industrialized countries, Israel's TFR has never fallen below 2.7. Much of that is attributable to the tendency of members of the Hassidic religious minority to have numerous children, but the secular Jews have above replacement TFR as well (Remennick 2008). Iceland and Ireland have both stubbornly and almost continually reported above 2.0 TFRs. Second, after plunging to the lowest of the low levels (<1.4 TFR) in the early years of the first decade, fertility rates have risen throughout most of Europe, although they remain for the most part well below replacement. Nonetheless, big, economically important countries such as Germany and Japan have had TFRs in the neighborhood of 1.3 for over two decades now, while Korea had been below 1.3 for over a decade. Singapore, despite impassioned pleas by the government, has seen an unrelenting decline in fertility to below 1.3 as well, while Hong

Kong, possibly because it is a crowded metropolis to begin with, has been spearheading the downward trend, placing almost consistently below 1.0 TFR since 1999.

Are the pessimists right this time? In order to answer this question, we must gain a better understanding the determinants of the variation of fertility rates. This is the purpose of the next chapter.

	2001	2009	Change
Australia	1.73	1.90	0.17
Austria	1.33	1.39	0.06
Belgium	1.76	1.83	0.07
Canada	1.51	1.66	0.15
Chile	2.10	2.00	-0.10
Czech Republic	1.15	1.49	0.35
Denmark	1.75	1.84	0.10
Estonia	1.34	1.63	0.29
Finland	1.73	1.86	0.13
France	1.88	1.99	0.11
Germany	1.35	1.36	0.01
Greece	1.26	1.53	0.27
Hungary	1.31	1.33	0.02
Iceland	1.95	2.22	0.27
Ireland	1.96	2.07	0.11
Israel	2.89	2.96	0.07
Italy	1.25	1.41	0.16
Japan	1.33	1.37	0.04
Korea	1.30	1.15	-0.15
Luxembourg	1.66	1.59	-0.07
Mexico	2.60	2.08	-0.52
Netherlands	1.71	1.79	0.08
New Zealand	1.97	2.14	0.17
Norway	1.78	1.98	0.20
Poland	1.32	1.40	0.08
Portugal	1.46	1.32	-0.14
Slovak Republic	1.20	1.41	0.21
Slovenia	1.21	1.53	0.32
Spain	1.24	1.40	0.16
Sweden	1.57	1.94	0.37
Switzerland	1.38	1.50	0.12
Turkey	2.37	2.12	-0.25
United Kingdom	1.63	1.94	0.31
United States	2.03	2.01	-0.03

Table 2.3: Total Fertility Rates OECD countries

Chapter 3

Determinants of Fertility

This is an overview of the determinants of fertility rates (TFR). I will focus initially on a discussion of those previously employed in the literature, and finally move on to the WVS-based predictors I plan to test. In discussing each potential determinant, I will present the evidence from extant academic studies and follow up with a brief empirical discussion, using to my data for each of the concepts. I do not expect the graphs and naive bivariate correlations in these subsections to provide us with explanations, only with more focused clues as to the phenomena that must be accounted for. At the end of each sub-section, following the literature and the descriptive data analysis, I will formulate a hypothesis regarding the effect of each variable on TFR. The determinants I will review fall into three broad categories: socio-economic indicators, incentives through government assistance, and cultural indicators. There are also a number of direct biological determinants, such as duriation of lactational infecundability, frequency of intercourse, sterility, spontaneous intrauterine mortality, and the duration of the fertile period. I will not be considering these, because I consider them exogenous.

There are numerous models describing potential determinants of TFR in the literature. In terms of causation models, they vary from the atheoretical correlation studies to full-

fledged causal models. The vast majority come pre-packaged with a number of relatively strong ex-ante assumptions about the composition of the data, which are rarely explicitly discussed. To prevent the same from recurring in this paper, my strategy here will be to:

1. Strive for a minimal set of assumptions;
2. Add weaker assumptions first and stronger assumptions later. Make known potential ways in which the assumptions might lead the model astray explicit.
3. Never add a covariant to the model that does not have a theoretical backing (no kitchen-sink approach).

The process is not as objective as the list might lead one to think. By "weak" I do not mean "unsatisfactory" but rather I define weak and strong in terms of the size of the leap of faith required to accept it. I will work from the fundamental premise that the fewer leaps of faith are required to accept a model, the better the model. A weak-assumption model should be preferable, *ceteris paribus*, to a strong-assumption model. This still leaves the issue of defining a way to separate the two, and here are a few of the criteria that I used:

- Is there a clear **causal mechanism** to link the determinant and the variable of interest (in our case TFR)? For instance, there is a clear and logical link between the availability of birth control and fertility: women who do not have access to birth control who are fertile and are sexually active are much more likely to become pregnant than fertile and sexually active women who use birth control. Indeed, we find that outside the OECD this factor is a strong predictor of fertility. "Availability of birth control" would thus be a weak

assumption, because it does not ask for much of a leap of faith. By contrast, a model that causally fertility with the prior presence of pets in the household (Serpell 1991) would require a lot more evidence to persuade me.

- Is there **ample extant literature** on the subject, with strong empirical evidence and theoretical arguments? A strong prior basis in the literature will reduce the "strength" of the assumption. For example, while the exact causal pathway by which it occurs has remained disputed, there is vast literature on the effects of female literacy rates on subsequent fertility rates.
- Is the theorized **causal pathway unique**? For instance, in the 1980s the relationship between the female labor force participation rate (FLFPR) and fertility rates was universally thought to be negative, yet in recent years studies are increasingly finding a positive relationship (Esping-Andersen 2009). The older theories advanced the argument that women entering the labor force face higher opportunity costs for having children, and therefore have fewer. The newer story suggests that instead, women might feel more secure about their financial situation and are therefore more likely to exit the labor force temporarily to have children. I would consider a claim about to the sign of any linear effect of FLFPR on TFR to be a rather strong assumption. It is entirely possible that in at some level of economic development or at some level of male-female income inequality level the sign of the relationship flips, making linear relationship claims suspicious.
- The model itself should be as simple as possible in terms of the statistical methods used and the ease of interpretability of the coefficients.

To summarize, a strong set of assumptions is one that makes very specific demands of the data, while relying on sparse support in the extant literature, or facing conflicting claims in the literature. The more convoluted the statistical model, the greater the need to show why the complex model was necessary.

The socio-economic indicators have been used the longest, and include measures of income, female labor force participation, part time employment, primary, secondary and tertiary education, infant mortality rates and even measures of urbanization. The causal relationship is not always straightforward, and scholars have often offered contrary causal stories. Not even the measurement of government intervention is as straightforward as one would hope. While governments usually keep records of their actions, these are not always made public. Furthermore, the channels for government assistance are almost as numerous as there are countries and vary from maternal/parental leave policies, to tax rebates and direct cash or in-kind assistance. Each of these also varies within the individual country over time, as programs are created, merged, replaced, repealed or enhanced. The bewildering diversity made it imperative to use a broad measure suitable for cross-national and cross-temporal comparisons. I use a measure of total government spending for families, as a percentage of Gross Domestic Product. Sadly, this measure does not include the value of tax credits, and will therefore underestimate the amount of government assistance in countries like the U.S. that rely heavily on tax credits. Such gaps will have to be addressed in future work. Moreover, there is no way to judge effectiveness of individual spending programs that comprise it -- in other words in our model a dollar spent is a dollar spent, regardless of how effectively designed the policy it is spent on. These are not trivial problems, and will surely increase the error range of our

estimates. Nonetheless, I decided that the gains in comparability from reducing the array of non-comparable programs outweigh the loss. The final set of estimators I use is comprised of data derived from the World Values Survey. Data from the WVS has been used in the past in conjunction to research on fertility rates, with special attention given to questions that seemed relevant to fertility, such as the desired number of children and the attitude towards abortion. (see Feyrer, Sacerdote et al. 2007) I am interested in testing the use of the value-sets from WVS as potential predictors of fertility, by employing Inglehart's two value dimensions. As discussed in the introductory chapter, the two are generated from a factor analysis of multiple response items on the WVS. The two dimensions are labeled the traditional/rational-secular dimension and the survival/self-expression dimension.

Problems of collinearly and data availability across the time series make a simultaneous test of all the variables impossible but a more in depth examination of the data and associated literature should help establish a criterion for inclusion.

Socioeconomic Indicators

What determines fertility? Before I delve into macroeconomic indicators, I must first acknowledge that no model will be perfect. At the individual level, there is considerable heterogeneity in terms of preferences (Hakim 2003). In the Hakim worker-mother model, 20% of women are strongly inclined towards children (home-centered) and would rather not work at all, 20% would put their career first (work-centered) and rather not have

children, and the remaining 60% are what she calls "adaptive" who desire a blend of both career and children. Preference heterogeneity can pose serious problems for an individual-level dataset that does not account for the possibility of non-uniform preference sets. If the desire to have children is shaped by many independent variables, the preference distribution would follow an asymptotically normal probability distribution function. I will assume that this is true and that therefore at the aggregate level of analysis these fluctuations in preference effectively cancel each other out at the population preference mean for each observation. Furthermore, according to the data in numerous surveys the stated population-level fertility preference is not identical to realized fertility outcomes in the population, but rather consistently below it. Women in most OECD sample nations, when asked, state a family size preference of 2 children or more (see Appendix), while realized fertility is significantly lower (D'Addio 2005). This could imply one of two things. First, the preferences stated in surveys are just "cheap talk," perhaps answering with a "socially acceptable" number, and realized fertility describes the true preference. Alternatively, it could mean that the process from desired to achieved fertility is contingent not only on individual preference, but also on the interaction with outside forces, resulting in a lower than desired fertility level (McDonald 2006). McDonald's critique does not strike me as particularly sharp or pertinent. After all, what human action takes place outside of any institutional-structural framework? I will rely on achieved TFR rather than "desired" TFR.

Figure 3.1 allows us to see the trends in fertility rates across the sample and over the past three decades. It seems that fertility has been declining in most of the countries over the observation period, with the steepest declines coming in the countries with the highest

fertility rates. This is in accordance to the fertility transition theory. We can see that the United States, France, the United Kingdom and Iceland have maintained near-replacement fertility throughout the period studied, while countries like Germany, Austria, Canada and Belgium exhibit three decades of significantly below replacement rates, with little if any variation. The group of former Communist countries shows a similar trend, with near or above replacement fertility before 1989 and persistent low fertility afterward. The Northern countries, by contrast, tend to have higher fertility towards the end of the study period compared to the levels they had at the start of the period.

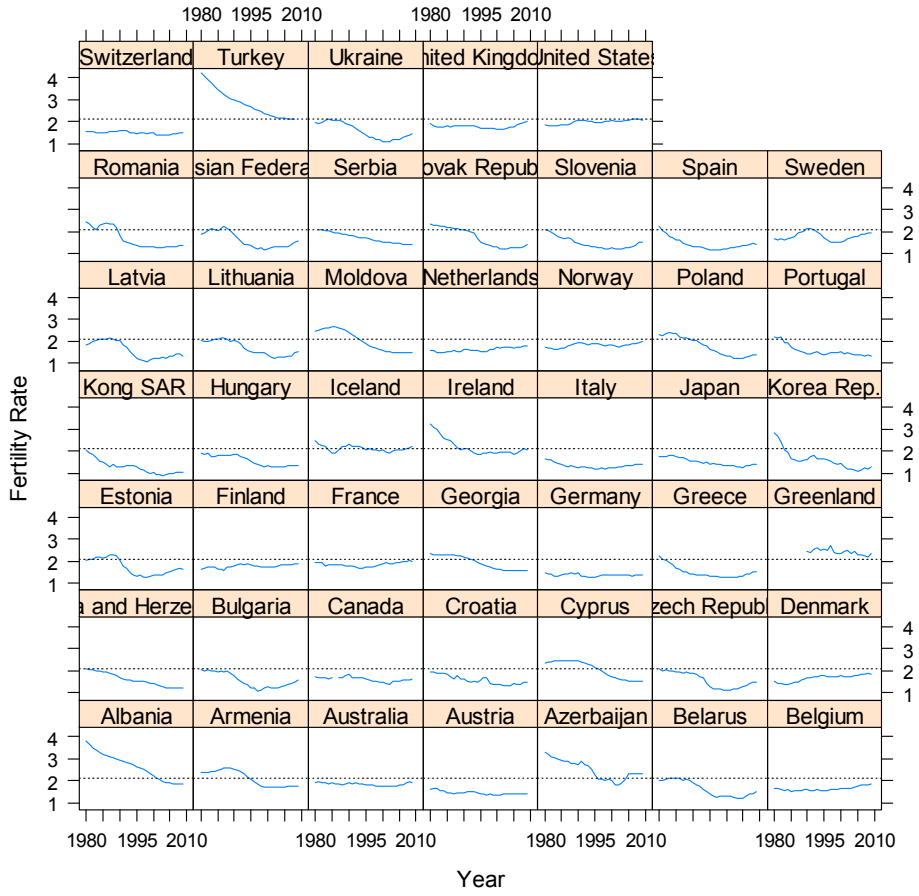


Figure 3.1: Fertility in the Study Sample, by Country and Year

I do not expect that all mothers will necessarily sit down with a pen and paper and calculate the marginal costs and benefits. However, humans *do* respond to incentives, and their behavior is likely influenced at least to some degree by economic realities. Using an "altruistic parents" model (Barro and Becker 1989) Becker compares children to “durable goods,” and argues that demand will increase with a couple’s income and with a decline in the children's “price” (Becker, Duesenberry et al. 1960, 231).While thinking of children as durable goods might strike one as odd, the idea that increased affluence has a positive effect on fertility is not new. Adam Smith mentions it in the Wealth of Nations, stating that prosperity and growth leads to the "multiplications of the species" (Smith 2009). Easterlin chose to emphasize the role of relative economic perception. The determinant, he argues, is not absolute wealth as much as the relative affluence of the potential parent's cohort, gauged against the remembered living standard of the cohort's parents (Easterlin 1973). Butz and Ward take the opposite view: fertility is likely to be counter-cyclical, since during times of economic boom, the opportunity cost for potential mothers to exit the labor market is greater. (Butz and Ward 1979). Macunovich (1996) suggested that, at least in the United States, fertility remained ‘pro-cyclical’ as the negative effects of unemployment on fertility surpassed the ‘positive’ effects of the ‘lower value’ of time during the recession: “periods of high unemployment appear to have a stronger effect in disrupting a woman’s expectations regarding future income streams than they do in providing “windows of opportunity” for pregnancy” (p. 251). In Sweden, Andersson finds a similar pro-cyclical pattern (Andersson 2000). I consider the Andersson-Macunovich argument to be more persuasive, especially as rates of female unemployment also correlate strongly with male unemployment. In most countries two-

adult couples (married or not) are still dominant, and the male losing his job will greatly increase the value of continued work for the women in that couple, canceling the effect of decreased time value in couples where only the woman lost her job. We can thus formulate our first hypothesis:

H1a: Unemployment has a negative impact on TFR.

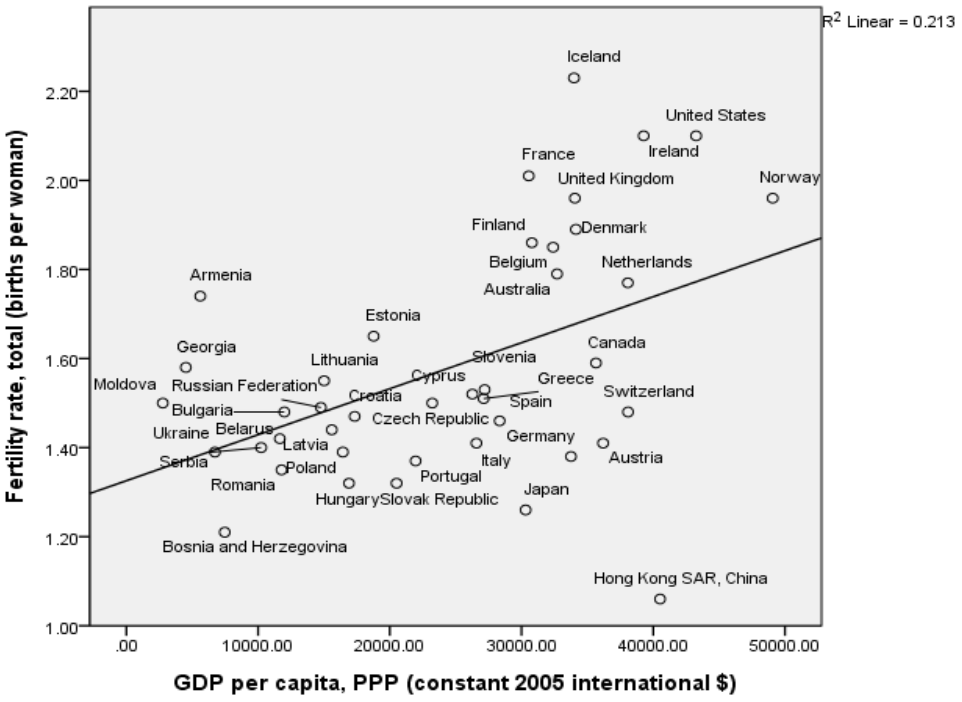


Figure 3.2: GDP and Fertility Rates in OECD.

If the Myrskyla et al model of fertility rising with HDI in a J-shaped curve is correct, then at high levels of GDP (a strong correlate of HDI) we should expect higher fertility as well. OECD countries are much richer than the average country on earth, so we can expect that most of the countries in the study will have high incomes, placing them at the lip of the J-curve, as it were. A quick glance at the data in Figure 3.2 suggests that there is indeed a positive link between per income and fertility, at least at the country level, which seems to go against the Butz-Ward hypothesis.

H1b: Contrary to the worldwide trend where per capita GDP is negatively associated with TFR, among the subset of richer countries in the OECD group, higher GDP per capita should be associated with higher TFR.

Given that the "price" of children is related to the opportunity cost for the woman's time, factor that affect how this time is valued are likely to impact on fertility as well. At the aggregate level it then makes sense to consider the rate of **labor force participation** (LFP) by women, since each woman in the labor force will have a higher opportunity cost. Academics are divided on even the sign of the causal relationship. The counter-argument is that the increase in income over the life-time of the parents due to female LFP more than outweighs the increased opportunity cost loss at the time of having a child, especially if childcare policies are structured such as to incentivize a quick return to the labor force. (Lappegård 2000; Esping-Andersen 2009). In a recent study, Lappegård and Duvander find that the two-child family is highly compatible with the combination of work and family life, but that in families who choose to have more children, the mother often seems to have a weaker work orientation (Duvander, Lappegård et al. 2010).

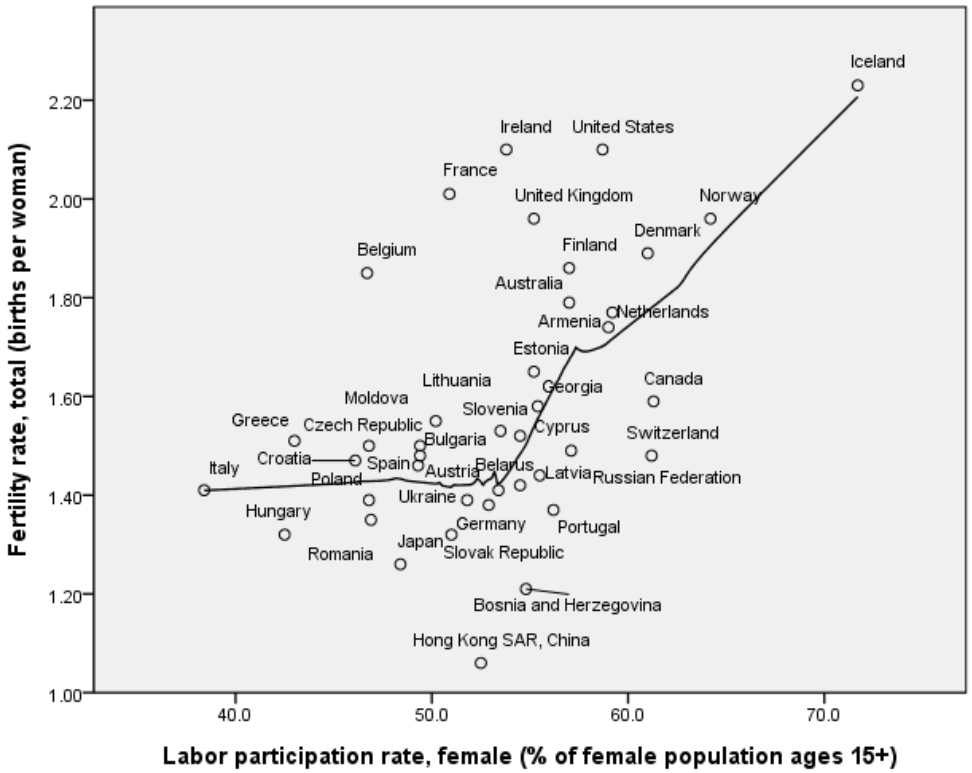


Figure 3.3: Labor participation rate by women. Nonparametric fitting indicates a strong positive relationship. Even after removing Iceland as a strong outlier, the relationship remained strong.

They conclude that while a high LFP might be compatible with a second child, LFP might hinder any further fertility. In Figure 3.3 I have displayed the results of a non-parametric loess regression of this factor on TFR. Iceland is a strong outlier and likely influences the results, but it is clear from the graph that LFP rates above 55% are associated with significantly higher fertility rates. In order to check whether this is an aberration of the data for the specific year chosen, I have performed the same test on the full dataset, with the results displayed in Figure 3.4 below. In the upper left part of the graph we see the traces left by high-fertility countries like Turkey, Ireland and Azerbaijan as they are rapidly lowering their fertility rates. The nonparametric regression pattern is stable and shaped the same as before, with the loess curve again curving upward at LFP levels above 55%. The concern about Iceland acting as a "magnet" is now compounded in

the time series observations, however. This highlights the need for a country-fixed effects model in the combined predictor model, which I develop in Chapter 4.

Figure 3.4: Labor Participation rate, female, all countries all years.

The methodology in the Esping-Anderssen paper is superb, and the theoretical argument quite solid, leading to the next hypothesis:

H1c: Among the sample OECD members, female labor force participation is associated with higher TFR.

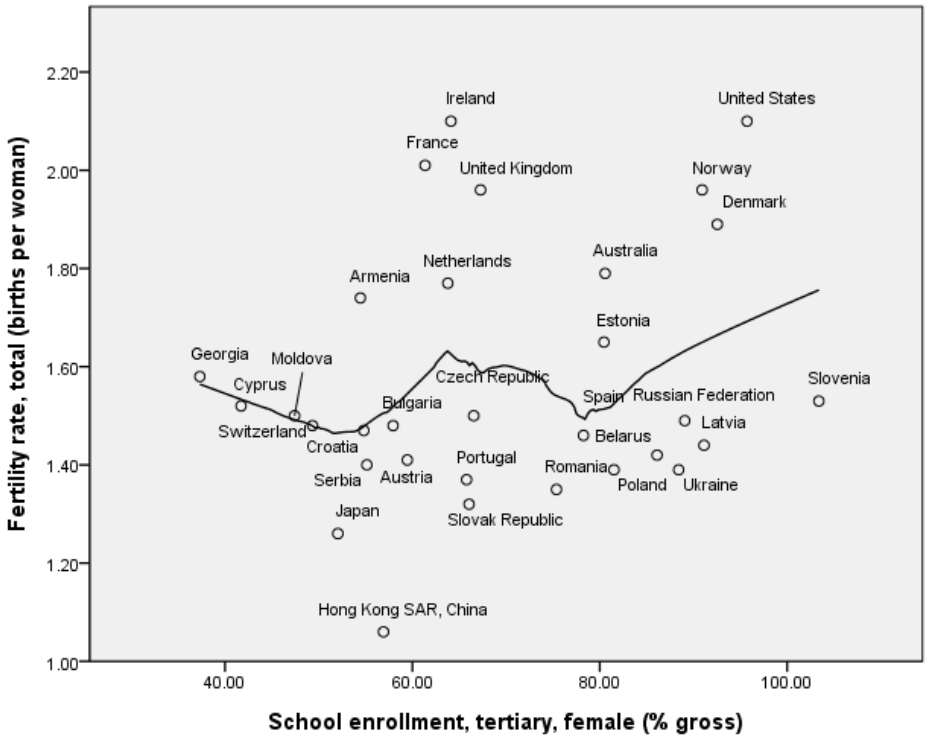


Figure 3.5: Tertiary Enrollment and Fertility. A nonparametric fitting indicates a weak relationship.

The remuneration a worker in the labor force will receive will depend in part on her skill-set, which she can increase through education. Since virtually all the OECD members have near-universal basic literacy, the simple metric of literacy or even more elegant formulations like literate-life expectancy (Lutz 1995) will be unable to discriminate between OECD members.

The situation is similar in terms of secondary school enrollment and completion, where only Turkey and Portugal lag significantly behind other OECD members. Primary and secondary school enrollment are thought to be a significant part of the mechanism of the first fertility transition. First, because they are in school, children now cost the family resources rather than provide for the family. The longer the children remain in school, the higher the costs incurred by the parents on their behalf. Following the Becker model, a rational family will therefore decrease the number of children it will voluntarily produce.

The unspoken assumption is that the family will rationally examine the cost of educating children in the future and discount it to present value, adding it as a cost, before a decision is reached on having another child. Again, I must emphasize that I do not expect this to actually happen, but the model can capture parental heuristic calculus, where future costs are taken into account, if not as rigorously as the model might assume. A quality-vs-quantity counter-argument was proposed by Kaplan et al., who use an evolutionary model to suggest a scenario whereby higher present costs are offset by the superior earning power of the children later in life giving the children ample opportunity to repay the extra parental investment in education (Kaplan and Lancaster 2003). This is disputed by Attias-Donfut et al. who conduct an empirical study and find that in Europe intergenerational financial transfers remain negative, with older adults continuing to transfer resources to their offspring even late in life, possibly in exchange for their children's time (Attias-Donfut, Ogg et al. 2005). A review of the literature on future educational costs of children does not provide a good way to decide on what the expected sign of the relationship between higher education and fertility would be (D'Addio 2005). Secondary education and tertiary education also contribute to lower fertility by another pathway, since by keeping girls in school, education delays the start of their reproductive lives for the majority, even though some sub-populations have remarkably high teenage pregnancy rates, especially in the United States. In her book *The Incomplete Revolution,* Gosta Esping-Andersen finds that at the individual level for Sweden, *parental* higher education is now positively associated with fertility (Esping-Andersen 2009), which is the opposite of the relationship that had been prevalent for decades across the world, where more educated parents generally had fewer children.

To summarize, the literature discusses three causal pathways by which education can directly affect fertility According to the first pathway, education makes children more costly for parents, but also much more productive. The causal relationship here is disputed. According to the second pathway, education decreases fertility simply by taking up time: a woman enrolled in secondary or tertiary education will generally try to avoid having children during her education. If tertiary education continues past a bachelor's degree, the reduction in the fertile window is significant. The problem with this argument is that since the total fertility rates in developed countries are relatively low (1-3 children per woman, far below the maximum theoretical number of children a woman can have across her life), it could be that education simply delays, rather than reduce, total fertility. Female higher education might simply be a costly signal (Arrow 1973; Bowen 1997). Sociologists have noted that marriage and cohabitation in recent decades have become ever-more segregated by socio-economic status and education, with most pairs formed within each group. Therefore, a woman seeking to attract a mate with higher education will find that acquiring a higher education is the best way to do so, regardless of her career/homemaker orientation. If we accept Hakim's heterogenous preferences model discussed at the start of the chapter, only 20% of women will strongly prefer being a home-maker (Hakim 2000). For the remaining 80% of women, it is unlikely that they will invest so much in education and then choose to remain outside the labor force for a considerable period. Education thus increases the future value of time, not only delaying births during the time taken up by education, but also increasing the opportunity cost of births after the end of education via labor force participation. See the section on female labor force participation for a discussion of the debated validity of that claim. If Esping-

Andersen's (2009) findings are true outside of Sweden, this would also be strong support for the idea that higher time value for women increases fertility. The mechanism for this effect would necessarily be indirect, going through higher labor force participation and higher earnings for women.

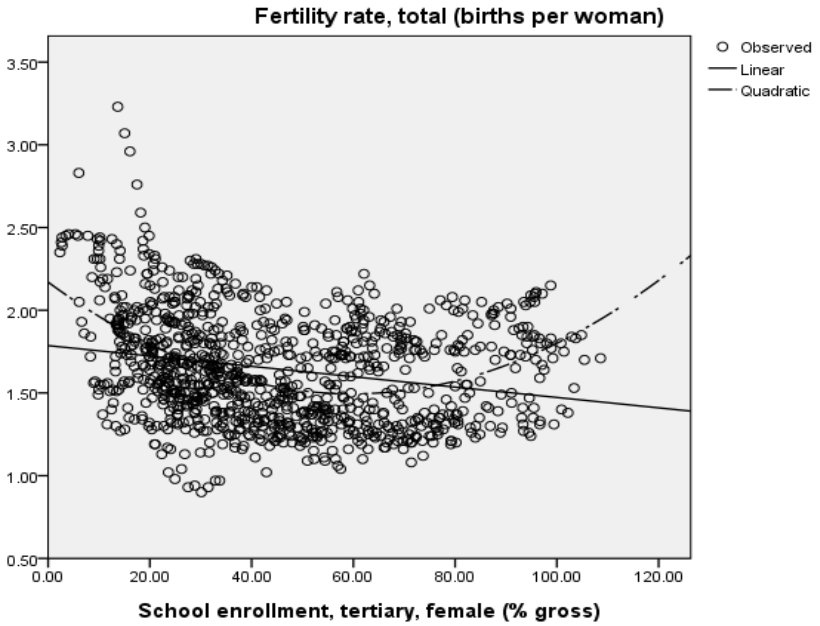


Figure 3.6: Changing Patterns of Tertiary Education and Fertility: A quadratic model has better fit (F=106) and higher explanatory power (R2=17%) than a linear model (F=56, R2=5%)

There is no information on the future enrollment rate for children born today, but current values can serve as a proxy for that. In addition, if we choose to use female tertiary enrollment, we can also account for the other two causal pathways. In the non-parametric regression in Figure 3.5, the relationship is unclear. Using the entire dataset and parametric regression is only marginally more edifying: a linear fit finds fertility negatively, if weakly (R^2<5%) co-varying higher education with OECD dataset. However, it seems vulnerable to high-fertility low-higher-education outliers. A quadratic (U-shaped) relationship, shows better fit (R^2~17%), and possibly fits the theoretical predictions of the Esping-Anderson model better. We can derive two models from this discussion:

H1d: Among advanced industrial countries, there will be a positive relationship between high tertiary enrollment rates for women and fertility rates.

H1e: The interaction of tertiary enrollment for women and female labor force participation should be positively associated with TFR.

With a causal mechanism on fertility that is very similar to one of those attributed to tertiary education, **the age of first marriage for women** has also been proposed as a predictor of lifetime fertility. In a previous chapter, I showed that Australian demographer J. C. Caldwell argued that delayed age of marriage was a driver of lower overall fertility before the advent of modern contraceptive technologies (Caldwell 1982). The mechanism here is again straightforward: to the extent that women tend to have children within the institution of marriage, a later onset of marriage reduces the number of fertile years during which she can potentially conceive. This is because without expensive assistive reproductive technology, a woman's reproductive fertility window is a lot shorter than her overall lifespan. According to biologists, for the average woman, fertility starts a slow decline around the age of 27, and the rate of decline increases greatly after 35 (Dunson, Colombo et al. 2002). In a rather surprising twist, a plot of the available data (Figure 3.7), fitted with a non-parametric loess curve suggests that at the country level, any further increase in the age of first marriage later than 26 is associated with a slight increase in TFR. This could be an artifact of the data -- countries with higher ages of first marriage might have some other characteristic that increases fertility. If our assumptions hold, it could mean that countries where women marry late see a "rush" of children in the last few years of fertility left to the late newlyweds. Alternatively, it could mean that one or more of our mechanism assumptions have failed. It could be, as it is

increasingly the case in Denmark, that women have children at older and older ages, with the help of reproductive technology (Schmidt 2006). Sobotka shows that " up to 7 percent of children of those native Danish women born in 1975 and later will likely be conceived by infertility treatment" (Sobotka, Hansen et al. 2008). Otherwise, the assumption that most of the children are born within the context of a married couple might have become invalid. If the married cohabitating family unit is no longer the main channel of

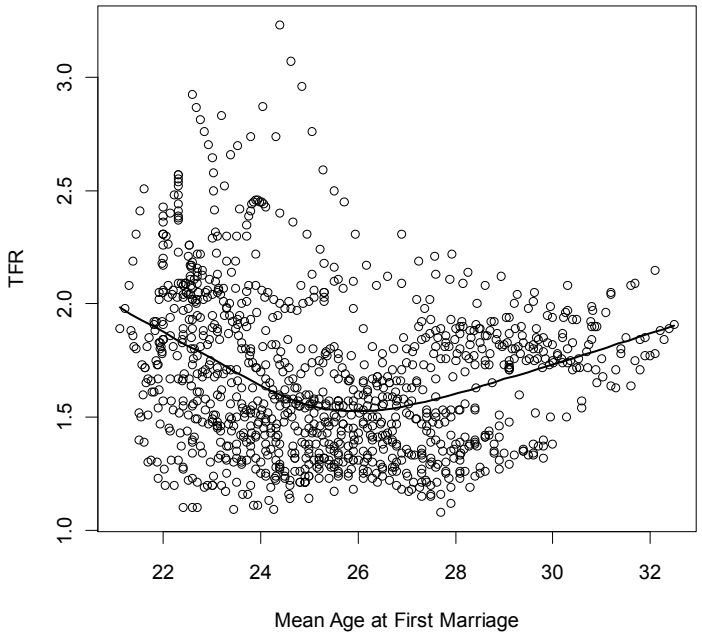


Figure 3.7: Mean Age at First Marriage with a loess curve plot.

reproduction, then at the very least, fertility might well become decoupled from the age of first marriage, aside from other social consequences of single parenthood.

Figure 3.8: Births to single mothers and Fertility

Figure 3.8 helps confirm our earlier hypothesis that the family unit has lost its undisputed primacy as the institution most closely associated with reproduction. Figure 3.9 shows that out-of-wedlock births have increased almost without exception throughout our sample in the past 30 years. Only Cyprus, Greece, Japan, Korea and Turkey have illegitimacy rates below 15% in our sample, while Bulgaria, Estonia, France, Iceland, Norway, Slovenia and Sweden see over 50% of births happen outside of marriage. It seems that women across the developed world have found themselves trading the security of marriage for cohabitation or single motherhood. Finally, in Figure 3.10, we see that as the mean age at first marriage has risen, so have the out-of-wedlock births. We can conclude that at least part of the increased fertility with delayed age of marriage is explained by the higher rate of births outside marriage.

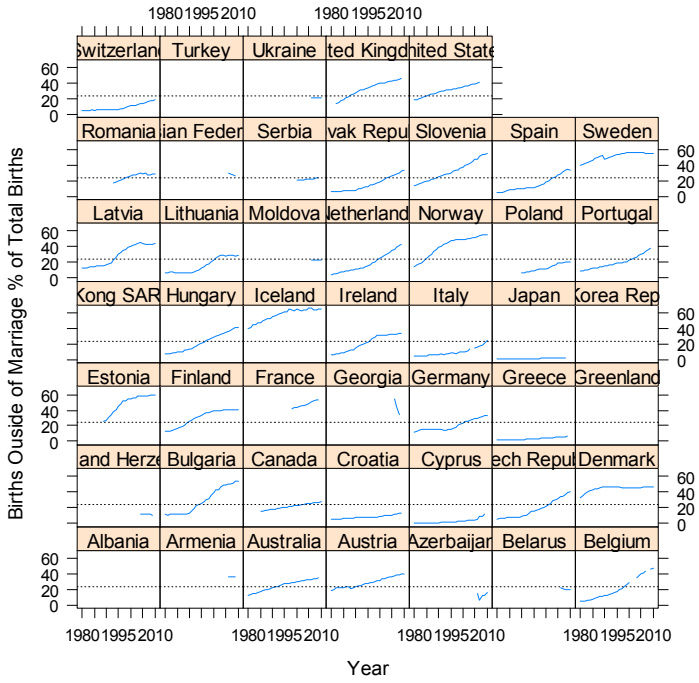


Figure 3.9: Births Outside of Marriage by Country and Year. Data are missing for Hong Kong and Albania, while Korea, Japan and Turkey have rates of illegitimacy <1% and are not visible on the plot. The dotted line at 23% is the 30 year sample mean.

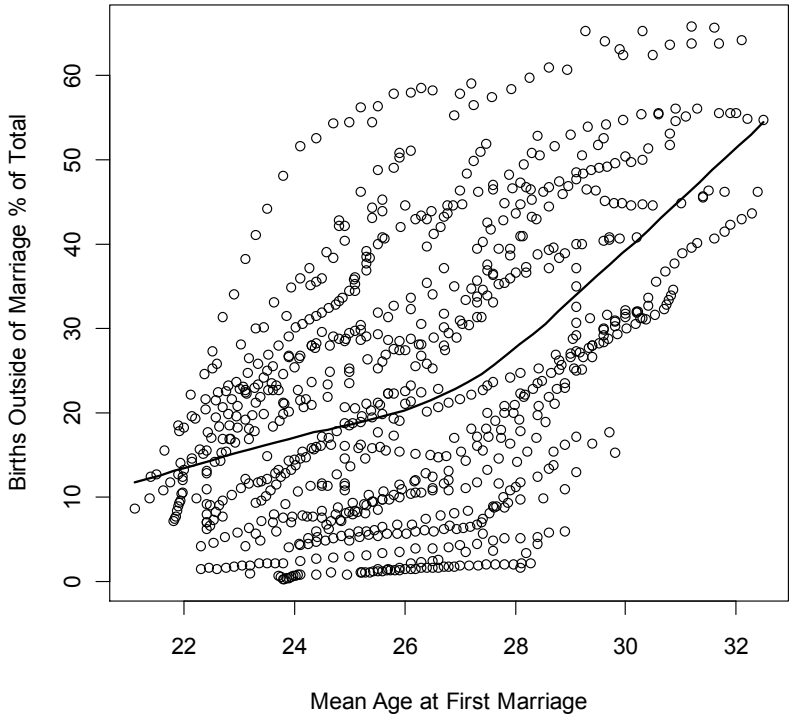


Figure 3.10: A high Mean Age at First Marriage is strongly associated with high single motherhood rates.

H1f: A later mean age at first marriage should result in a decreased fertility rate.

H1g: A higher rate of children born out of wedlock as a percentage of the total number of children should be associated with a higher fertility rate.

Urbanization is part and parcel of the ongoing modernization process. Fleeing what Marx once called the "idiocy of rural life" people have been flocking to the cities in their millions. The impact on fertility, while probably indirect, has been clear: urban areas have historically had a lower fertility than rural areas as women in cities study longer and marry later than their rural cousins (Sharlin 1980; Watkins 1987). More directly, urbanization leads to a relative increase in the price of living space, while rearing children is far easier when living space is more abundant. This makes the relative cost of children rise with each increment in the price of housing (Heer 1968). Both mechanisms point in the same direction, leading us to expect higher urbanization to result in lower fertility. The empirical data in Figure 3.11 supports this claim, illustrating the transition from a world of mostly high fertility and low urbanization, to a high urbanization, low fertility world. Within the developed-world context of our 30 year sample (Figure 3.12), we find the same negative relationship, if somewhat attenuated, because most of the sample had already completed the first fertility transition. A multivariate analysis should help establish the direct effect of urbanization, rather than via higher literacy and delayed marriage.

H1h: Increased urbanization will have a detrimental effect on TFR.

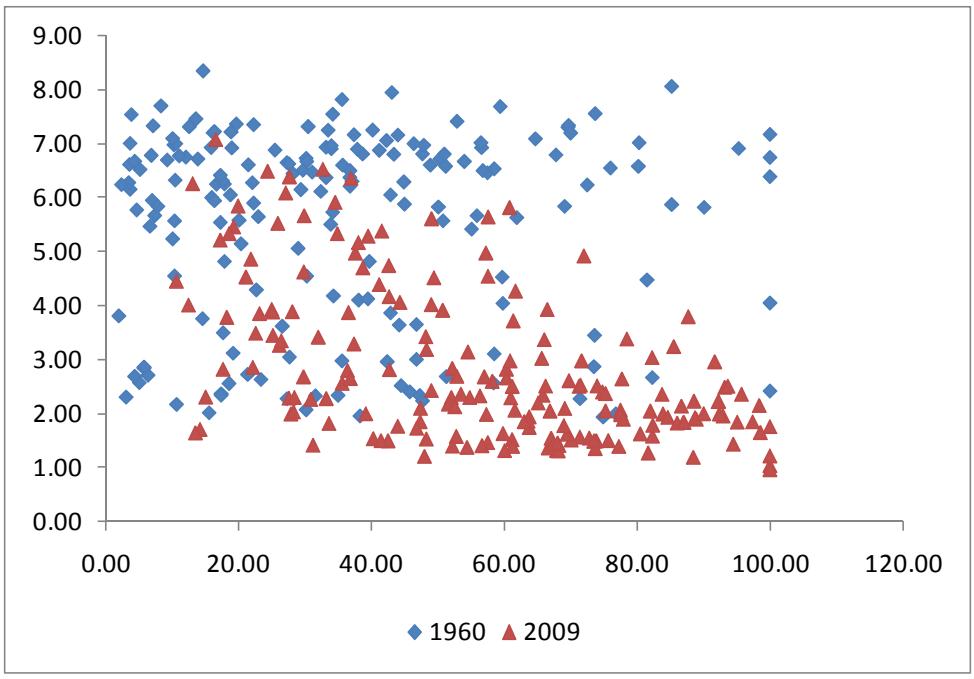


Figure 3.11: A dual snapshot of urbanization and fertility across the entire world: 1960 (squares) and 2009 (triangles). Computed using World Bank Data.

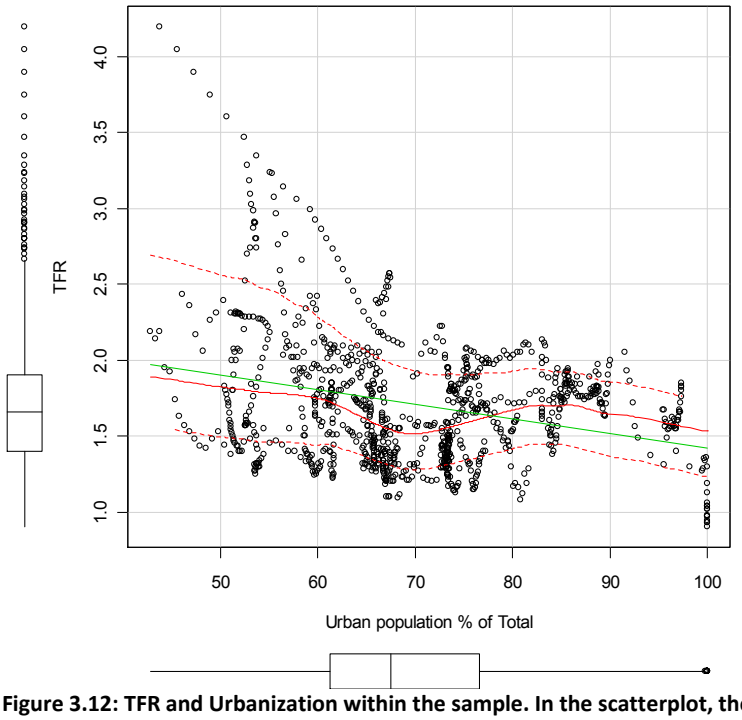


Figure 3.12: TFR and Urbanization within the sample. In the scatterplot, the negative relationship holds across the time series, with both a linear estimator and a loess nonparametric regression in agreement.

Finally, from within the rational-economic context we have been using, it is rational to insure against uncertainty. The idea behind using infant mortality as a predictor is that higher fertility can serve as insurance in a high mortality context: by having more children, the parents increase the likelihood that enough of them will survive to adulthood. But does the theory apply in the post-fertility-transition context as well? Using Israeli microdata Ben-Porath finds that "experienced mortality reduces the probability of stopping at a given birth (i.e., raises the number of births) and reduces the intervals between births" (Ben-Porath 1976) . The relationship was confirmed by Chowdhury with using cross national comparisons (Chowdhury 1988; Cigno 1998). However, Doepke finds that even with declining infant mortality and declining fertility the number of surviving children can increase (Doepke 2005), concluding that declining child mortality cannot account for the decline in net reproduction rates in industrialized countries. The cross-national data show a positive relationship between fertility and infant-mortality, even in the low-mortality context of the OECD. However, the data is strongly concentrated around very low mortality and the slope is therefore mostly influenced by several high-mortality outliers.

Restricting the analysis to a snapshot of the latest data, as in Figure 3.14 below, suggests that, within the low-mortality context of the industrialized countries in the sample, it is actually the ones with the lowest mortality that show the highest fertility rates. A loess regression confirms this trend, before climbing back up to meet the two (relatively) high mortality outliers, Georgia, Moldova and Armenia. There is no known mechanism in the literature by which lowest-low mortality would directly influence

fertility positively, so this result is probably due to correlations between low mortality and other measures.

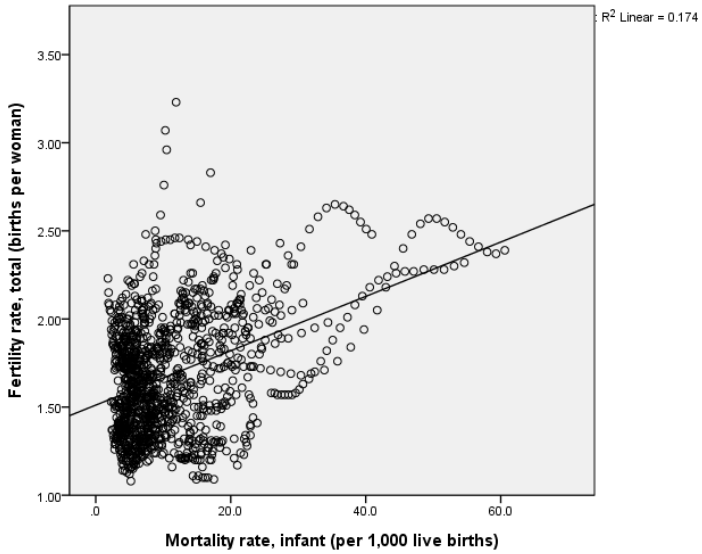


Figure 3.13: Infant mortality and Fertility, whole dataset.

Lowest of the low infant mortality is strongly associated with a stellar health-care system, and health care outcomes are part of the definition HDI through its life expectancy component. Infant mortality is probably not a strong predictor of fertility among industrialized nations.

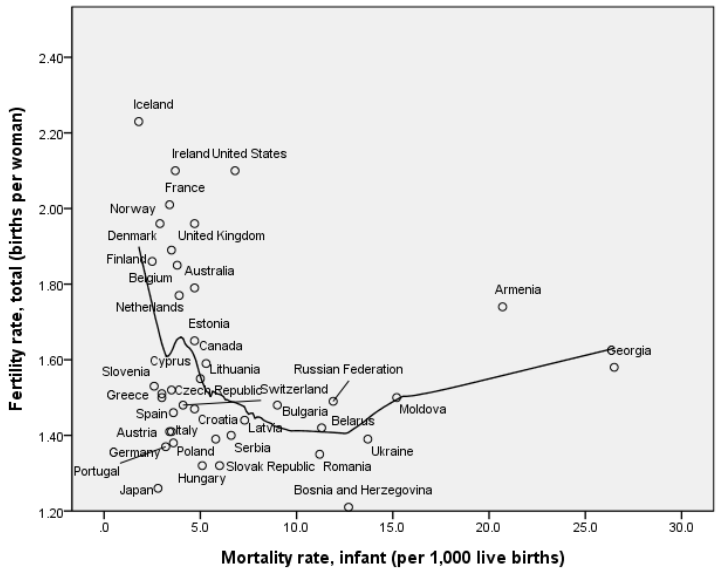


Figure 3.14: Infant mortality and Fertility, latest data only

Public policies

Public policies have an undeniable impact on families and fertility decisions. Among other things, they regulate the conditions of employment, define eligibility to welfare and childcare subsidies, provide education and health services, and set out the rights and responsibilities of parents. Curiously for a spending program involving billions of USD per annum, the effect of government spending in support of families is unclear. Our rational-decision model discussed earlier would suggest that each marginal decrease in the cost of having children should result in a marginal increase in the number of children born. This simple analysis is complicated somewhat by the fact that the money to pay for childcare policies and other pro-family measures must come from the taxpayers, perhaps a case of robbing the right hand to pay the left hand. It is not even clear that the spending is actually effective. Gauthier and Hatzius conduct an econometric survey of 22 industrialized countries between 1970-1990 and conclude that "cash benefits in the form of family allowances are positively related to fertility" but nonetheless "the effects of policy appear to be small". Gauthier and Hatzius quantify the impact of increases in family payments as being 0.07 of a child for a 25% increase in expenditure (Gauthier and Hatzius 1997). Castles uses OECD data from 20 nations for a single year and finds a positive relationship between spending and fertility (Castles 2003). In a study of the effect of cash benefits for children introduced in Norway in 1998, Aassve finds a strong positive effect, most pronounced among conservative households (Aassve and Lappegård 2009). However, other studies using macro-level data have concluded that the impact of policies on fertility is most likely on the timing of births rather than on the total

number of children (Gauthier 2007). Since governments are not often in the business of running controlled experiments, many of these policies do not have a counterfactual (what would have happened in the absence of the policy) so assessing policy effectiveness is difficult. McDonald argues that government policy can be effective, but only if it is "correctly" apportioned, providing plenty of policy suggestions but relatively little in the way of concrete evidence to augment his claims (McDonald 2006).

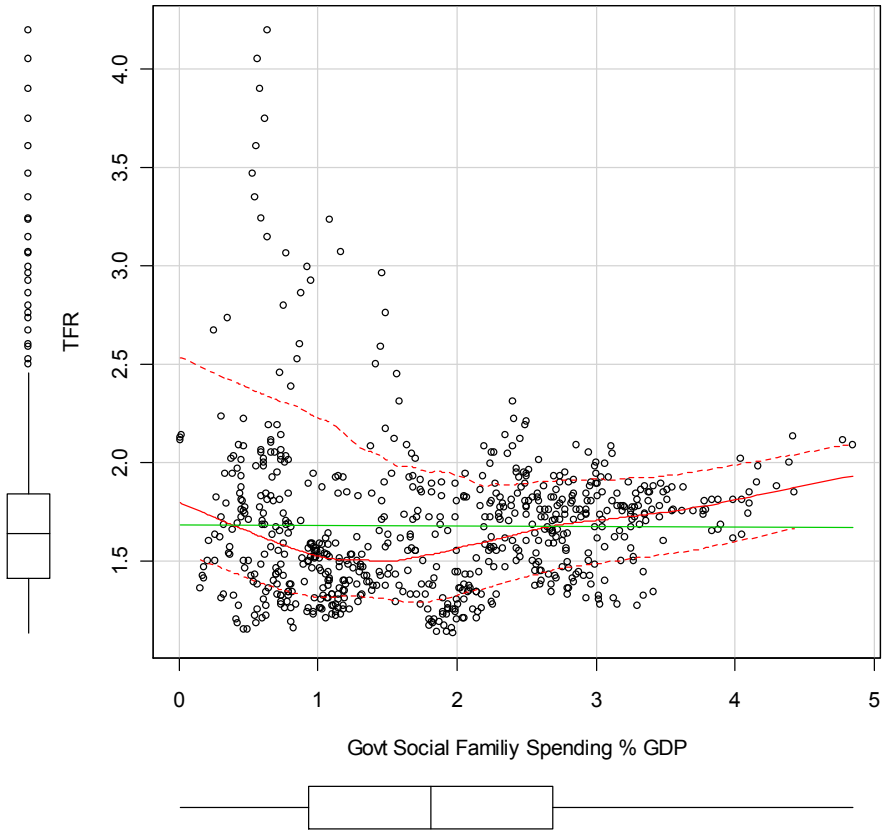


Figure 3.15: Spending on families. A linear trend on the scatterplot suggests no effect. The Loess estimator recovers a positive trend at expenditure levels above 1% of GDP.

As discussed earlier in the chapter, I use a measure of total government spending for families, calculated as a percentage of Gross Domestic Product. This measure does not include the value of tax credits, and will therefore underestimate the amount of government assistance in countries like the U.S. that rely heavily on tax credits. On the

positive side, the estimate will therefore be an underestimate of the true effect, so the only net effect of this omission is to make a successful test all the more significant. The simple linear trend calculation illustrated in Figure 3.15 suggests that there is no relationship between spending levels and fertility scores - a horizontal line with $R^2=0$. The high-fertility outliers (quickly undergoing the final stages of the first fertility transition) are charted on the top left on the graph and are influential points, skewing the linear result. The loess nonparametric estimator does not have the same sensitivity, and outside the range of the outliers, it indeed detects a positive fertility trend at GDP spending levels above 1%.

H2a: Social spending on families by the Government is associated with higher rates of fertility.

Government policy can also have an effect via the regulatory framework over labor. By allowing and encouraging different norms, governments can have a powerful effect over how workers and their employers interact. Unfortunately, cross-national time series are not available for work schedule flexibility, a measure of what percentage of the female workforce have some freedom in deciding their work schedules on a regular basis. The intuition here is that a young mother will find it a lot easier to juggle parental responsibilities and a career if she has the ability to alter her work schedule to suit her needs. I chose to focus on the female side of the labor force because for now, despite increased male contributions at home, women remain the primary caretakers. Using OECD data for 2007, I show a positive relationship between labor force flexibility for women and TFR.

The positive relationship in Figure 3.16 is what we would expect, given the assumptions of our rational decision making model - as Hill et al. argue, job flexibility should make it easier for women to be employed, increasing their net income and decreasing the cost of children (Hill, Hawkins et al. 2001). In contrast, using survey data from 11 countries, Ariza found a positive relationship only in half, and a negative relationship in the other 6 countries (Ariza, de la Rica et al. 2005), suggesting that some cultural or institutional factor might be at work. In the absence of better data, this will remain at the level of speculation.

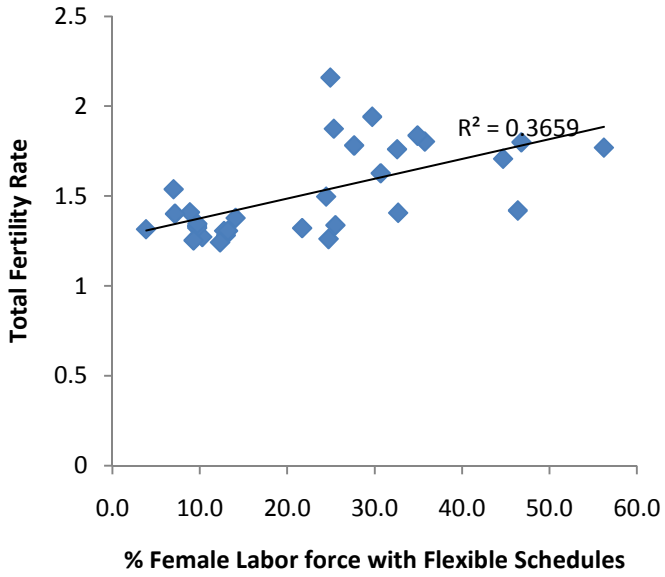
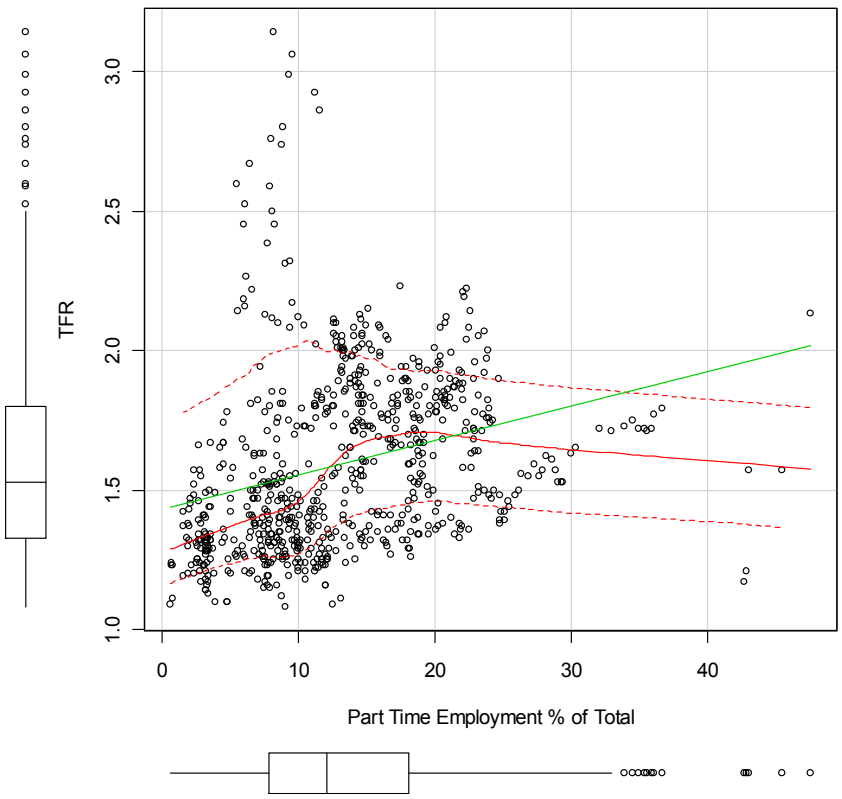


Figure 3.16: Flexible schedules seem to boost fertility, but data is sparse

One year's worth of data cannot yield useful estimates in a time series analysis, but as mentioned earlier, no one has made available a cross-national time-series dataset about flexible labor practices. Instead, I have decided to use a less powerful proxy of labor flexibility, part time employment. It is tempting to assume that part-time work and job flexibility are two very similar measurements, and to a significant extent, this is true. If

the physical and mental effort of childrearing leave the mother willing to be in the workforce, but unable to put in a full 40 hours a week, a part time job can make all the difference. As a measure of labor market flexibility, part time employment could help increase fertility by allowing mothers to balance a childcare and a job (Del Boca 2002), although Engelhardt finds no such relationship (Engelhardt and Prskawetz 2004). Ceteris paribus, a society where it is easy to form part time job arrangements should see an increase in TFR. The proxy I use (women employed in part time jobs as a percentage of total jobs for women) does not measure the ease with which such arrangements can be created, but their prevalence in the work force.

This means that aside from mothers seeking part time work, several other data-generating sources may be contributing to the observed share of part time jobs available. From the supply side, employers might be unwilling to hire anyone full-time because the macroeconomic situation might be difficult, because restrictions on hiring and firing regular workers are too strict, or because the conditions during employment are too onerous for the firm to maintain its desired level of profitability. From the demand side, a high proportion of part-time employment could be a sign of income insecurity (unable to find a full-time position, the person chose a part-time position rather than be unemployed). Both probably take place to some degree, and this will contaminate our results. In theory, this problem could be mitigated by simply subtracting involuntary part-time employment from the part-time rolls, but the set of assumptions undergirding the definition of involuntary part-time work are rather heroic, and it would still leave the possible supply side contamination in place.



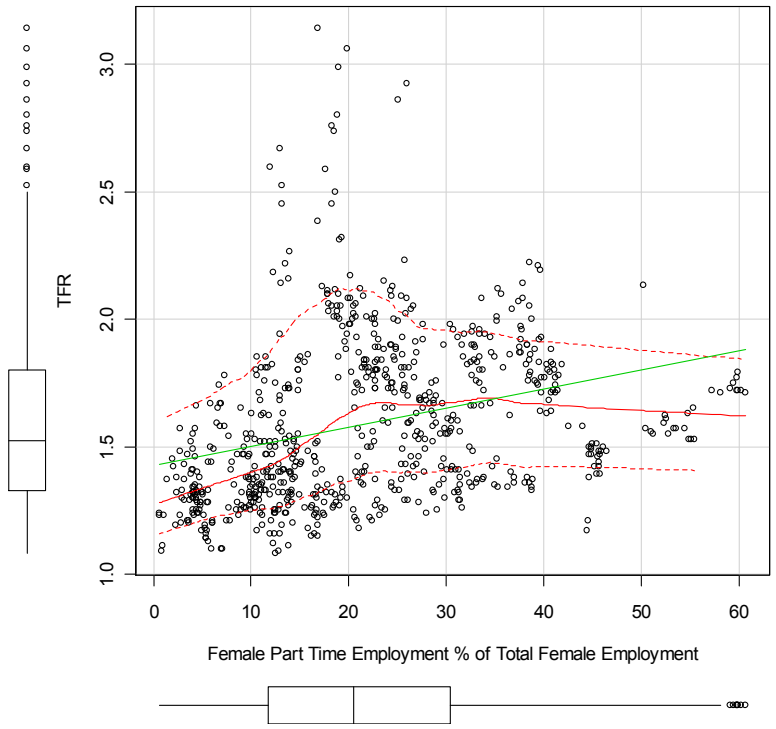


Figure 3.17: Part Time Employment: Total (top) and Female (bottom)

Can the measure still be trusted? Luckily, both potential contaminants work against the mechanism of part time maternal employment described earlier. People are more likely to try to have children when they have financial reserves, rather than when they are drawing on them (Kravdal 1994), so job insecurity (the demand side contaminant) would be a negative influence. Similarly, a restrictive labor market (the supply side contaminant) with high barrier to enter and exit the workforce, will greatly increase the opportunity costs of having children. Both contaminants therefore are likely to dampen the effect, making the significance test harder to pass. Therefore, a significant result would be significant *despite* the potential contaminants.

H2b: Increased prevalence of female part time employment has a positive effect on TFR

Cultural Measures

All of the variables in this section are actual questions from the World Values Survey and the European Values Study, or aggregate measures derived from such.

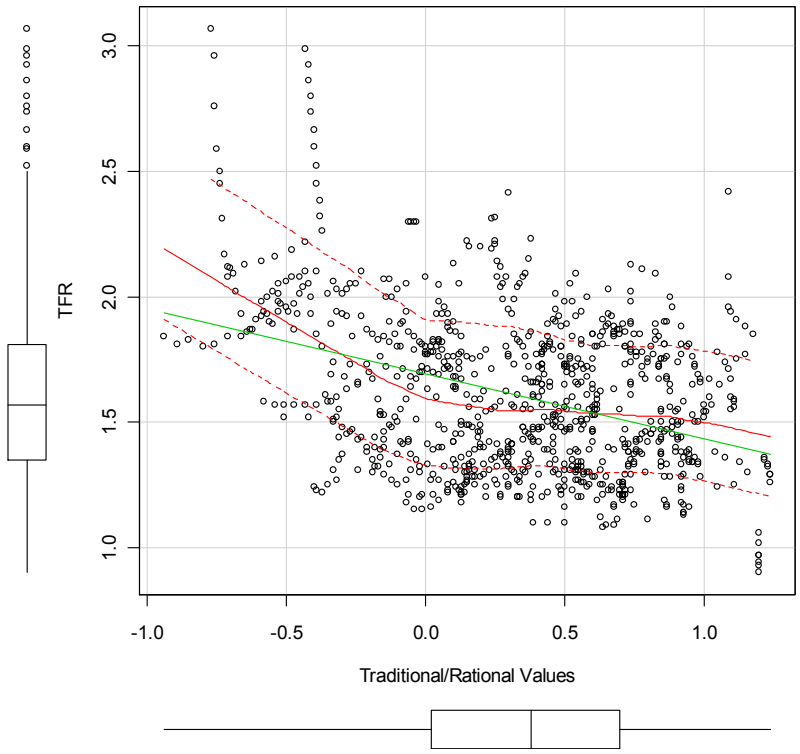


Figure 3.18: Traditional dimension and fertility, OECD countries

As mentioned earlier, WVS data has been used previously in the context of fertility by Feyrer, who used several questions regarding attitudes towards abortion and the survey responder's realized number of children as part of an individual level analysis (Feyrer, Sacerdote et al. 2007). Without focusing on the issue in detail, Inglehart

observed that "people in traditional societies idealize large families, and they actually have them. High scores on the traditional dimension are strongly correlated with high fertility rates" (Inglehart and Baker 2000). The relationship is graphically illustrated in the OECD data in Figure 3.18 above, showing fertility decreasing as traditional values are replaced by rational-secular ones. The causal pathway is rather straightforward. Increased Rational-Secular values lead to decreased levels of community and family ties. Since families and deep support networks have traditionally been the primary supporting institutions behind child-rearing, a weakening of these ties should lead to decreased TFR. Similarly, the move away from traditional values also results in detachment from formal religious worship. Churches have historically sought to boost the fertility of their adherents, as a way to maintain or even boost their membership. In the past, a strong selection effect has acted in favor of churches capable of boosting the fertility of their flock and retain members born within their ranks. To this day, the Catholic church frowns upon birth control, although few adherents now pay heed to these admonitions, and most churches (Christian or otherwise) reject the use of abortion as a means of birth control, with more traditional churches opposing the practice more vehemently. Churches can also provide non-material (spiritual) compensators that for believers help defray the opportunity costs in foregone personal consumption that arise when having children. Finally, church communities can provide support networks for new parents, with advice, baby-sitting and parent activities.

H3a: Higher Traditional/Rational scores will be associated with lower levels of fertility.

The Traditional/Secular dimension already includes data on attitudes towards abortion, but nonetheless I have included the data here because it has been used in the literature before and it has a direct impact on fertility rates. The high correlation with the Traditional dimension, it will not be in the final analysis, but the OECD data presented a surprising inversion. The survey respondents were asked to rate the justifiability of abortion on a ten point scale, with options ranging from 1 (Never justifiable) to 10 (Always justifiable). In Figure 3.19, OECD countries with more liberal attitudes towards the justifiability of abortion actually display higher fertility rates than most of those who have negative views on the topic (with the exception of Ireland).

A similar pattern emerged when examining attitudes towards the justifiability of divorce (Figure 3.20). Countries that show a more liberal attitude towards divorce (scores over 5) show consistently higher levels of fertility than those with lower scores.

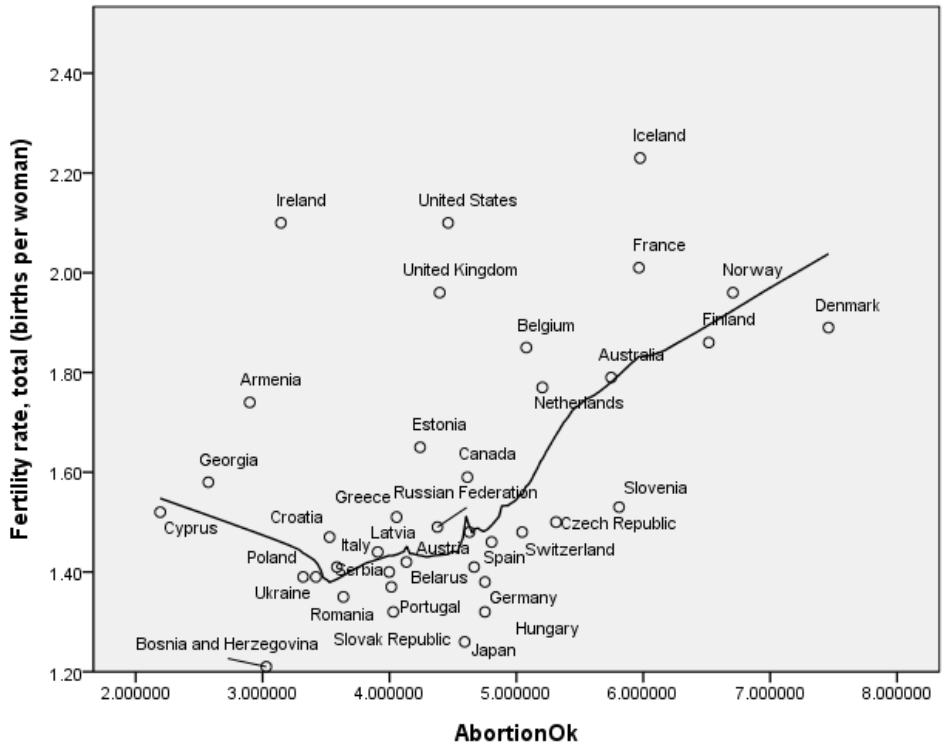


Figure 3.19: Survey responses on the acceptability of abortion and fertility. Higher numbers indicate a more permissive attitude towards abortion. Among OECD countries, fertility is actually higher among publics that are more permissive.

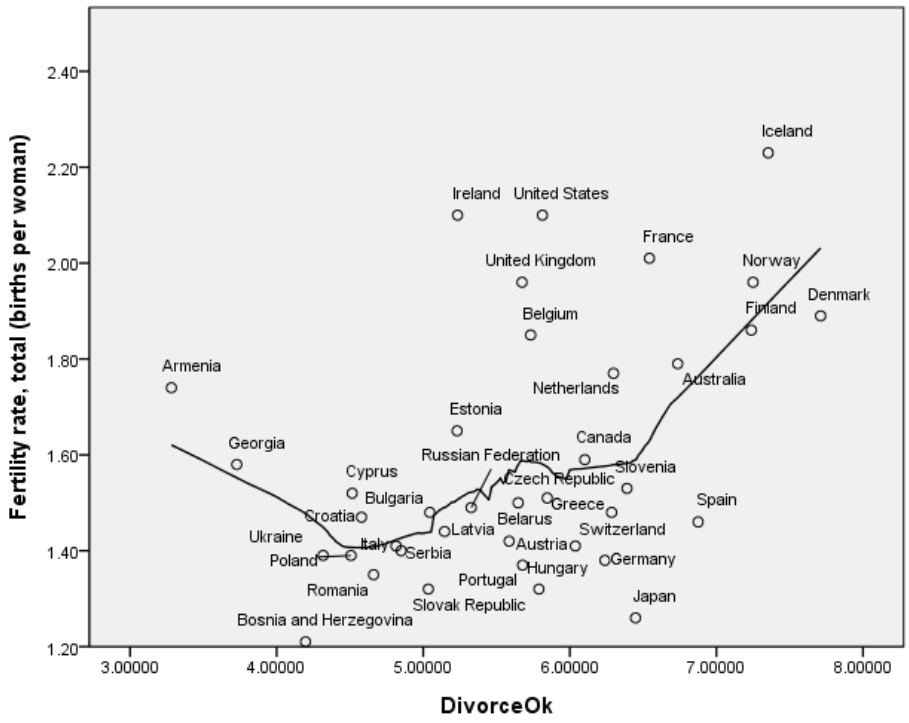


Figure 3.20: Attitudes towards divorce and fertility in the latest data available. Higher numbers indicate a more permissive attitude towards divorce.

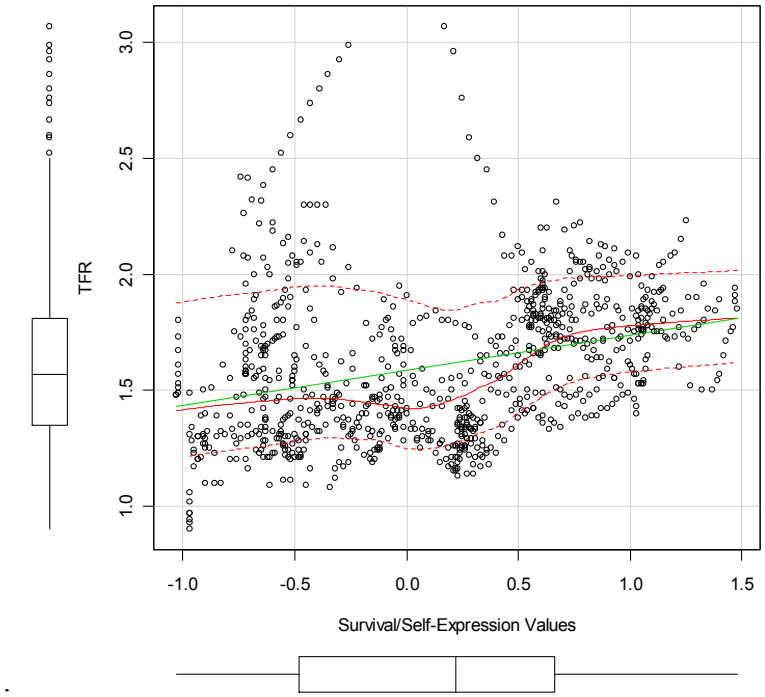


Figure 3.21: Survival/Self-expression in the OECD time-series. Higher S/SE values are linked to higher fertility.

The traditional/rational measure has seen previous use in the context of TFR. Inglehart and Norris, during their discussion of the consequences of secularism, mention a strong and significant negative relationship between high secular/rational values and the measures of fertility (Inglehart and Norris 2004). The relationship between the second cultural dimension (the survival/self-expression projection) and TFR is not explored in depth, but it is implied to also be negative. As societies shift from being survival oriented toward being self-expression oriented, the individuals living in these societies experience a profound transformation. In societies focused on survival, children are seen as the primary means of old age support and thus vital, whereas in the latter children are seen as a self-expressive choice (van de Kaa 2002).

	Women need children to be fulfilled	When jobs are scarce, men should have priority
Women 15-35	39%	12%
Women 35-50	45%	19%

Table 3.1: Attitudes toward children and marriage, average of entire datasample for latest available period. Compiled from WVS data.

In Table 3.1 I present the results of two questions asked in a recent WVS survey. I have separated and aggregated the responses for two subgroups, women between 15 and 35 and women aged 35 to 50, and restricted only to those countries in the current survey (mostly OECD). The first question asked the respondents whether they think women must have children in order to be fulfilled. Within the 15-35 age group, 39% answered yes, and within the 35-50 group, 45% answered yes. A majority of women from the OECD space do not think children are a necessary condition for self-fulfillment. The second question asked the respondents if they agreed with the statement "When jobs are scarce, men should have more right to a job than women." Only 12% and 19% among 15-35 and 35-50 respectively answered in the positive, indicating widespread support female wage-earning employment.

In light of these findings, should we then expect the relationship between Survival/Self-expression values and TFR to be negative? Nothing is ever so simple: being a mother can be very fulfilling, and as gender-based wage inequality decreases and glass ceilings are shattered, balancing childbearing and a successful career is not outside the realm of possibility. At the level of the entire world, the correlation between TFR and Self-Expression values is strongly negative, but is it possible that high enough Self-expression values might actually nudge women towards having another child? A famous example of such a shift is the relationship between fertility and scores on the Human

Development Index (HDI is an aggregate measure of education, life expectancy and income). As late as 1996, Bongaarts and Watkins declared that "there is a highly significant negative correlation between HDI and fertility ($R^2 = 0.6$)" (Bongaarts and Watkins 1996). Thirteen years later, Myrskyla et al. revealed that the relationship turned non-linear after a certain critical level (HDI = 0.86) was passed (Myrskylä, Kohler et al. 2009). They were quick to draw the link to the population decline issue: "our findings reduce, if not yet completely reject, fears of population decline that have been incorporated in many national population forecasts for highly advanced countries." (8) This claim ignored the fact that Japan, one of the biggest gainers on the HDI scale over the interval Myrskla studies, continued its fertility decline, and that most high HDI countries made only negligible gains in fertility.

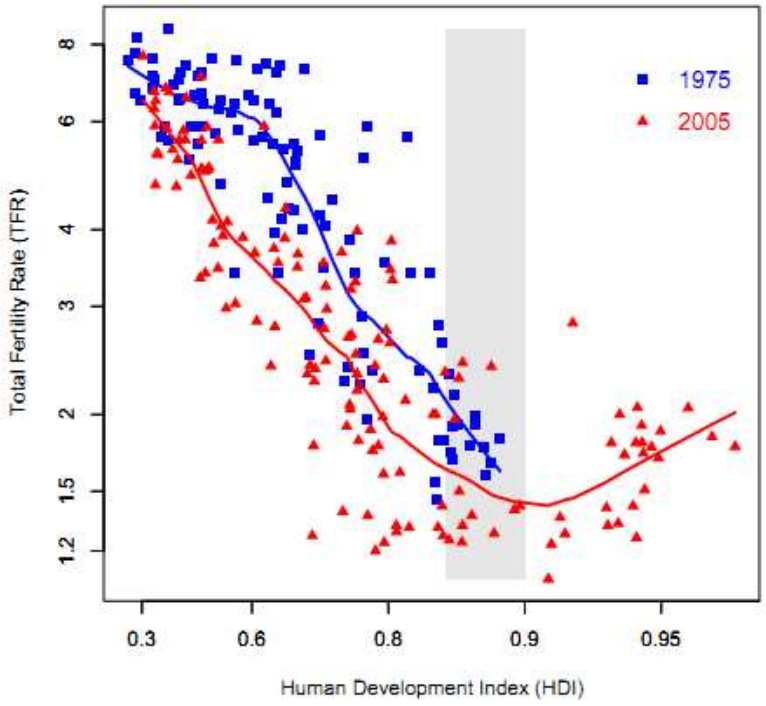


Figure 3.22 HDI and TFR, from Myrskyla et al. By 2005, high HDI became associated with moderately higher TFR.

While some high HDI countries experienced a moderate recovery, others did not. It is likely that some other variable, that correlates in some way with HDI, is playing a role here. We know that HDI and Survival/Self-Expression share a relatively strong correlation. (Inglehart and Norris 2003). This lends plausibility to the possibility that the relationship between Survival/Self-Expression and TFR is also J-shaped, with a positive relationship for higher values. The literature is silent on the subject, and to my knowledge the WVS value dimensions have never been used in relation to fertility outside of the brief mention in the context of religious-secular contrasts in *Sacred and Secular* (23-26 and 235-239), and never as year-on-year panel data.

We thus have no past theoretical work on the topic to rely on, and two competing causal stories, one suggesting a strictly negative relationship between Survival/Self-Expression values and TFR, the other suggesting that the relationship might become positive at high levels of Self-Expression following an J-shaped curve akin to HDI and fertility. I will rely on empirical testing to reject or accept these hypotheses.

H3b: Along the Survival/Self-expression cultural axis, increasing Self-Expression values are negatively related to TFR levels.

H3c: Above a certain threshold value, the relationship between Survival/Self-Expression values and TFR becomes positive, while the relationship is negative below it.

Chapter 4

Empirical Analysis

Structure of the Dataset

The data for this empirical analysis covers 45 countries over the period from 1980 to 2009. The data sources are diverse. I rely primarily on United Nations (UNdata, UNICEF TransMONEE and ILO Laborstats), World Bank (the massive WDI-GDF dataset), OECD (iLibrary SOCEX) and Eurostat data but I have also made use of various national statistics databases to fill out missing information where possible. The cultural indicators are derived from the six World Values Survey waves, with matching questions from the European Values Study surveys added in. The WVS are carried out on average once every four years in each country, but in some instances due to WVS-EVS overlap, two surveys of the same country are only a year apart. Aside from Hong Kong, which was only covered once in 2005, all other countries have been repeatedly surveyed, with at least 3 surveys in each country. Examination of the data reveals a high level of consistently linear trends among repeated surveys in each country, without massive jumps from year to year (Inglehart and Welzel 2005). Since most of the countries have five or more surveys available at this point, the average gap between two surveys is only

4 years, making linear imputation of missing years between WVS surveys in those cases relatively unproblematic.

Descriptive Statistics

	Valid N	Minimum	Maximum	Mean	Std. Deviation	Data Source
Fertility rate, total (births per woman)	1308	.90	4.19	1.752	.4409	United Nations (UNdata)
Survival/Self-Expression	895	-1.22	1.48	.1424	.64976	WVS, computed index
Traditional/Rational Secular	895	-.9	1.2	.332	.4650	WVS, computed index
Govt. Family Assist. %GDP	669	.01	4.85	1.8407	1.03563	OECD iLibrary, SOCEX
School enrollment, tertiary, female (% gross)	1113	2.32	108.59	43.0291	24.47455	World Bank, WDI/GDF
Labor participation rate, female (% of female population ages 15+)	1350	24.0	75.6	51.600	8.7376	World Bank WDI/GDF
Part time employment, female (% of total female employment)	722	.6	60.7	21.916	13.0186	UN ILO Labor Statistics Database
GDP per Capita at PPP, constant 2005 USD	1237	1303	49070	18891	10473	World Bank WDI/GDF
Urbanization	1400	33.8	100	67.61	13.79	World Bank, WDI/GDF
Children Born outside of Marriage	1001	0.25	65.72	23.87	16.183	Eurostat, Various National Statistics
Mean Age at First Marriage	1094	21.10	32.5	25.49	2.615	Eurostat, Various National Statistics
Unemployment, total (% of total labor force)	949	.60	36.41	8.1315	4.62297	UN ILO Labor Statistics Database
Valid N (listwise)	443					

Table 4.1: Descriptive Statistics of the Dataset

	Fertil	FamSpend	GDPppp	Marry1st	BirthOutW	LFP	EducFemTer	Urban	Unempl	PartTime	TradRat	SurvSelf
Fertil		0.32	0.39	0.28	0.46	0.42	0.14	0.32	-0.25	0.40	-0.26	0.54
GDPSpendFam	0.32		0.17	0.48	0.65	0.42	0.11	0.31	-0.29	0.15	0.53	0.39
GDPppp	0.39	0.17		0.57	0.36	0.44	0.50	0.40	-0.60	0.63	0.10	0.74
MeanFirstMarr	0.28	0.48	0.57		0.54	0.37	0.43	0.33	-0.36	0.48	0.29	0.61
BirthOutWed	0.46	0.65	0.36	0.54		0.75	0.47	0.36	-0.44	0.21	0.35	0.46
LFP	0.42	0.42	0.44	0.37	0.75		0.36	0.32	-0.58	0.39	0.30	0.57
EducFemTer	0.14	0.11	0.50	0.43	0.47	0.36		0.06	-0.23	0.03	0.02	0.28
Urban	0.32	0.31	0.40	0.33	0.36	0.32	0.06		-0.27	0.48	0.20	0.53
Unempl	-0.25	-0.29	-0.60	-0.36	-0.44	-0.58	-0.23	-0.27		-0.48	-0.28	-0.46
PartTime	0.40	0.15	0.63	0.48	0.21	0.39	0.03	0.48	-0.48		0.07	0.68
TradRat	-0.26	0.53	0.10	0.29	0.35	0.30	0.02	0.20	-0.28	0.07		0.20
SurvSelf	0.54	0.39	0.74	0.61	0.46	0.57	0.28	0.53	-0.46	0.68	0.20	

Table 4.2: Correlation Matrix

The correlation matrix in Table 4.2 has been color-coded to indicate high correlation levels, both positive and negative. Using variables with high correlation levels in the same regression analysis will introduce problems of collinearity into the error terms, and if the correlations are high enough, create super-influential outliers that can skew the coefficient estimates. The average correlation level is 0.24, and the level of correlation between the independent variables is worryingly high.

To assess the danger to the model, I use an *R* implementation of the regression collinearity diagnostic procedures found in Belsley, Kuh, and Welsch (Belsley, Kuh et al. 1980). These procedures examine the "conditioning" of the matrix of independent variables. The analysis computes the condition indexes of the matrix. If the largest condition index (the condition number) is large (Belsley et al. suggest 30 or higher), then there may be collinearity problems. All large condition indexes may be worth investigating. The variance decomposition proportions associated with each condition index provide further information that may help to identify the source of these problems. If a large condition index is associated two or more variables with large variance

decomposition proportions, these variables may be causing collinearity problems. Belsley et al suggest that a large proportion is 50 percent or more.

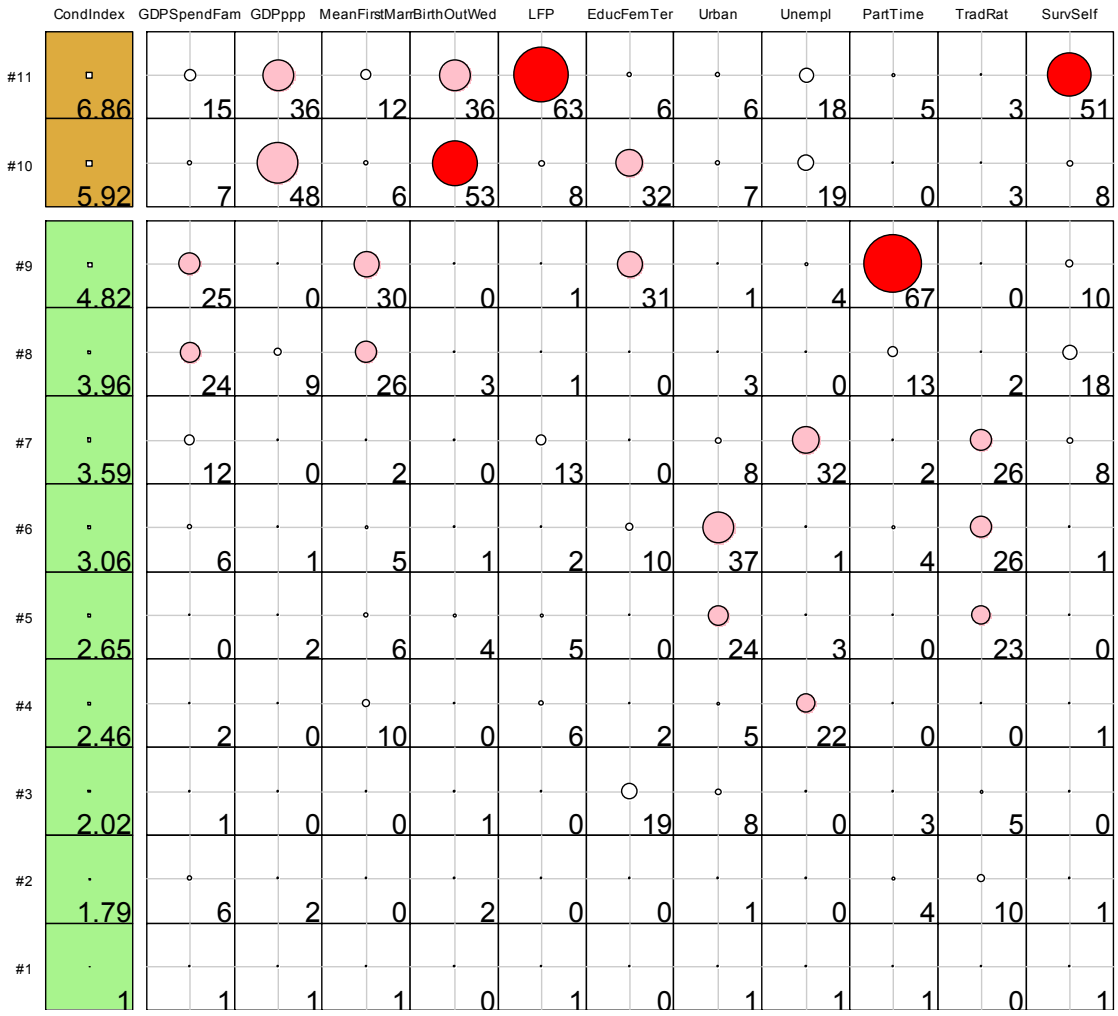


Table 4.3: : Tableplot of the 11 detected condition indices and variance proportions for the regression data. In column 1, the symbols are scaled relative to a maximum condition index of 30. In the remaining columns, variance proportions (×100) are scaled relative to a maximum of 100.

Table 4.3 above displays the result of the regression collinearity diagnostic. 11 condition indices were calculated, and their values are displayed in the first column. All the indices have values below 30, which is reassuring for the integrity of the model. However, for three of the indices, there are variance proportions above 50%. From the

condition index 11, it appears that the combination of GDP per capita, Births outside of wedlock, Female labor force participation and Survival/Self-Expression in the same model will cause collinearity problems. Condition index 10 warns that the combination of GDP per capita, Births outside of wedlock, and Tertiary female education in the same model can also be a source of collinearity. Finally, in condition index 9, we can deduce that the combination of Female part time employment, Female Tertiary Education, Mean age at first birth and Government Spending on Families as % of GDP can also cause multicollinearity problems. This analysis shows that we cannot run a simultaneous model of all variables, but will have to test them in two batches instead to avoid crippling collinearity problems.

Analysis

Perhaps the simplest question we can ask when looking at the data is whether there actually is significant variation in the variable of interest, in our case, total fertility rates. The question is pertinent, especially since I have restricted the dataset to comprise mostly OECD and a few other industrialized European nations. In accordance with the First Demographic Transition theory, all of

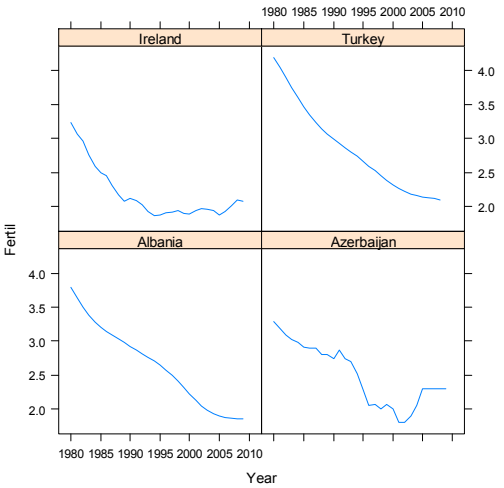


Figure 4.1: Countries still completing 1st Fertility Transition

these states have seen reduced mortality, and have also completed the transition towards reduced fertility from the levels seen in pre-industrial agrarian countries (or in the case of Albania, Azerbaijan and Ireland and Turkey were in the process of doing so, as can be seen in Figure 4.1). The theory does not specify a higher or lower threshold, nor does it tell us whether we should expect all countries to converge to a specific value, although the ex-ante general expectation among demographers was that there would be a convergence around replacement (2.1) TFR (Lesthaeghe 1995).

We can model the relationship thus:

$$y_{it} = \beta + \epsilon_{it}, \qquad i = 1, \dots, n, \qquad t = 1, \dots, T_i \qquad (4.1$$

where y_{it} is the observed fertility rate for country i at time t, β is the mean fertility rate across the entire population in the sample, and ϵ_{it} are independent $\mathcal{N}(0, \sigma^2)$ error terms. The number of countries is n=45 and the number of observations for each country is T_i with a maximum span of 31 years (1980-2010). Because of data gaps, we have an unbalanced panel, so some countries may have more valid observations than others. The total number of observations for the current model is $N = \sum_i^n T_i = 1308$.

Fitting this first simple model in the *R* statistical package, I find $\hat{\beta} = 1.75$ and $\hat{\sigma} = 0.44$. This indicates that significant variation does exist within the dataset. Looking back at ***Table 4.1*** we can see that the numbers are indeed the mean and standard deviation of the fertility rate variable. Figure 4.2 below shows the residual plots for each country across the 30 year time horizon. More than half of the countries have residuals

significantly different from 0. This suggests the next step in the analysis: fixed country effects.

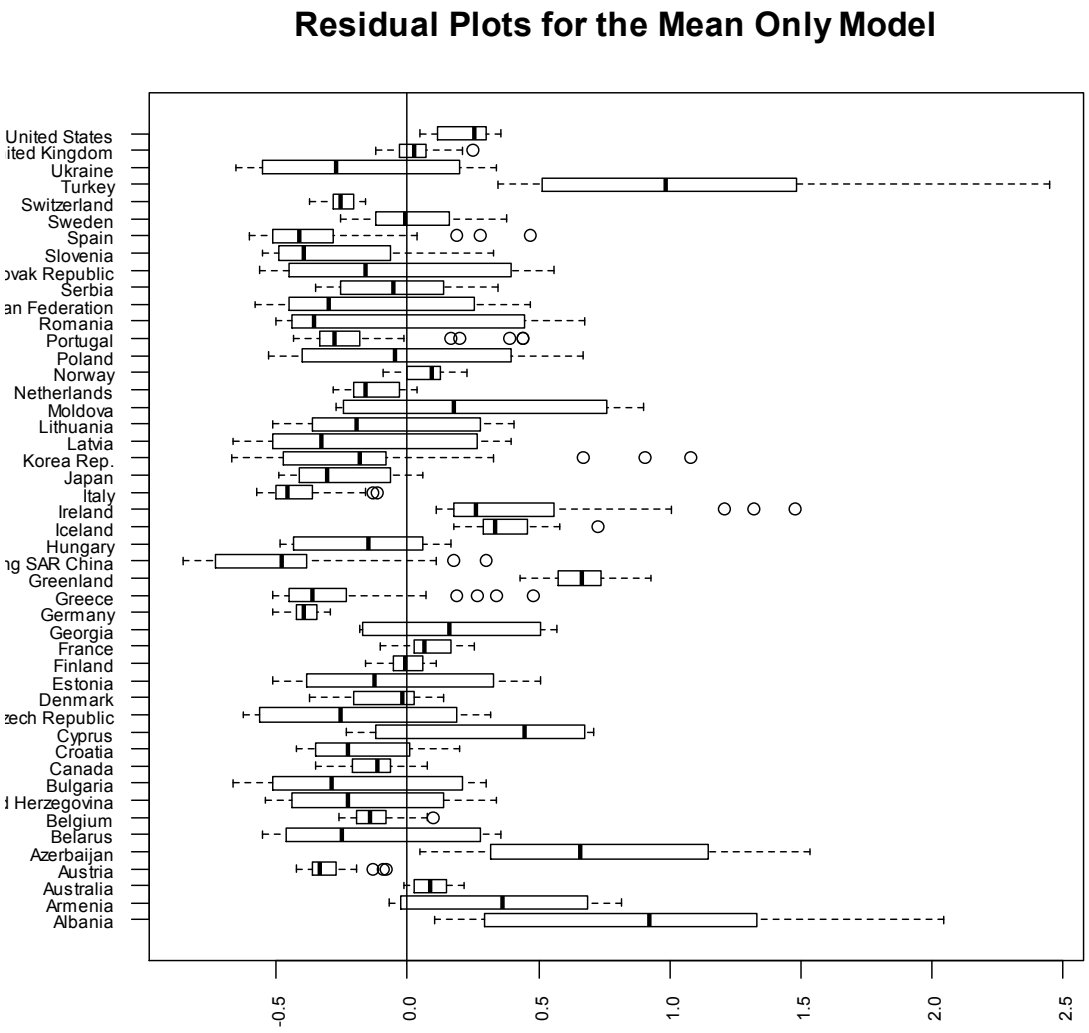


Figure 4.2: Residual plots for means only model

The country effects indicated in Figure 4.2 may be incorporated into a model for TFR by allowing each country to be represented by a separate parameter. This fixed-effects model for one-way classification can be described by the formula:

$$y_{it} = \beta_i + \epsilon_{it}, \qquad i = 1, \dots, n, \qquad t = 1, \dots, T \qquad (4.2$$

where β_i represents the mean fertility rate in country i, and as in (4.1 above ϵ_{it} is the normally distributed error term. The parameter estimates are given in the Appendix. The residual standard error for this model is 0.303. Accounting for country level fixed effects explains only 30% or so of the observed variation in the data.

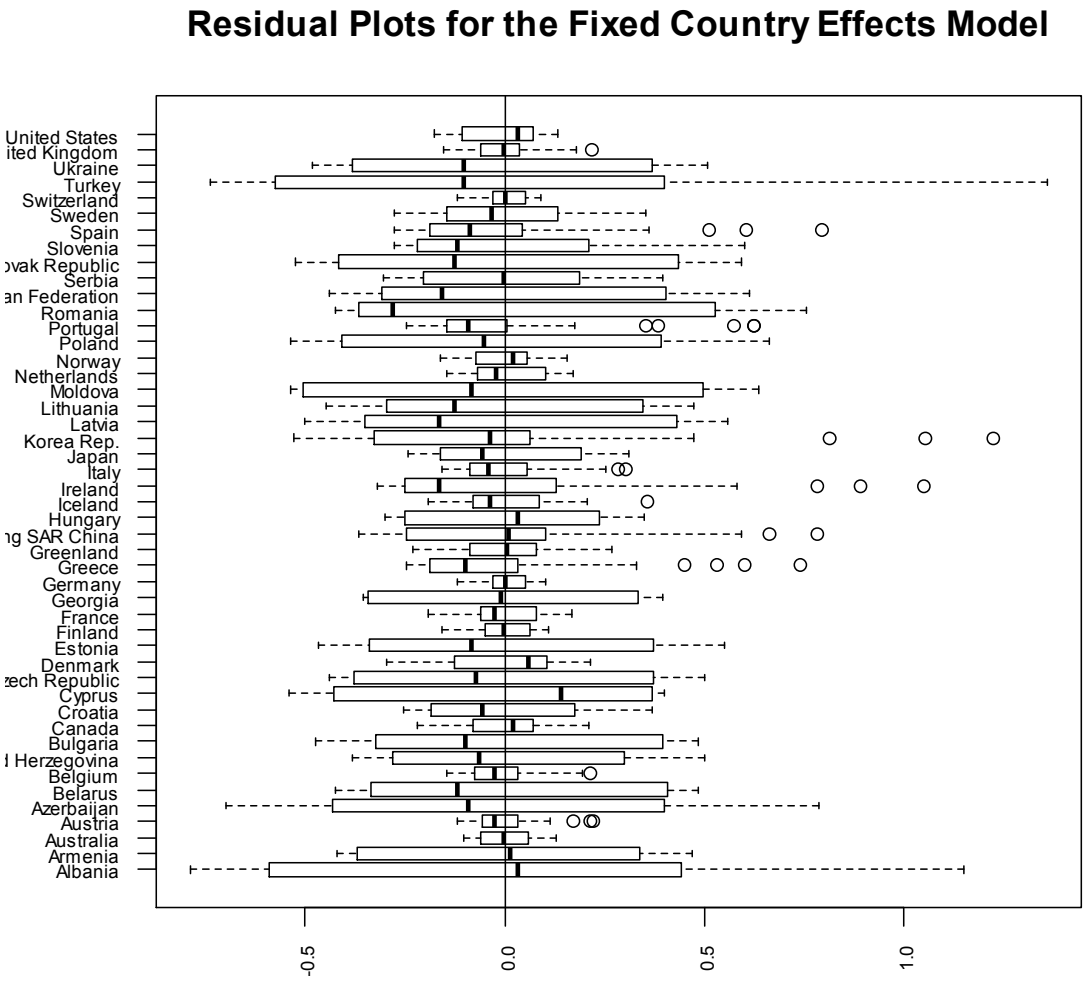


Figure 4.3: Residual plots for Fixed Country Effects

We can perform a similar test to check for across-countries time variation, using a simple least squares model:

$$y_{it} = \beta_0 + \beta_T t + \epsilon_{it}, \qquad i = 1, \dots, n, \qquad t = 1, \dots, T \qquad (4.3$$

where β_0 is an intercept, β_T is a fixed coefficient for time effects. Estimating the model I obtain $\widehat{\beta_0} = 2.09$, $\widehat{\beta_T} = -0.0219$ and a $\hat{\sigma} = 0.398$. The residual error is high compared to the TFR sample average (0.44) suggesting that a time efffect cannot account for more than 11% of the variation in the dataset.

A combination of the least square model for time and fixed effects for the country

$$y_{it} = \beta_0 + \beta_i + \beta_T t + \epsilon_{it}, \qquad i = 1, \dots, n, \qquad t = 1, \dots, T \qquad (4.4$$

yields $\widehat{\beta_0} = 2.99$, $\widehat{\beta_T} = -0.0225$ and a $\hat{\sigma} = 0.2307$, with an F-statistic of 79.8 which means that this simple but powerful model explains about half of the variation not accounted for in the initial mean model.

Other variables must account for the remainder of the variation. Ideally, we would like to estimate a model with data grouped by country, and generate estimators for all the other covariates within each country. These would take the shape:

$$y_i = \boldsymbol{X\beta} + \boldsymbol{Z_t b_t} + \epsilon_t, \qquad t = 1, \dots, T, \qquad b_i \sim \mathcal{N}(0, \Psi), \quad \epsilon_i \sim \mathcal{N}(0, \sigma^2 \boldsymbol{I}) \qquad (4.5$$

where $t = 1, \dots, T$ are observations within each country, $\boldsymbol{\beta}$ is the p-dimensional fixed effects (where p is the number of covariates in the model), Z is the matrix of random effect variables, Ψ is the variance-covariance matrix for the random effects, and $\sigma^2$is the variation in the error term. However, with a maximum of only 30 (and frequently fewer) observations per country, the reliability of any but the simplest estimators is highly doubtful. We must use a simpler indicator.

Residual Plots for the LS Time and Fixed Country Effects Model

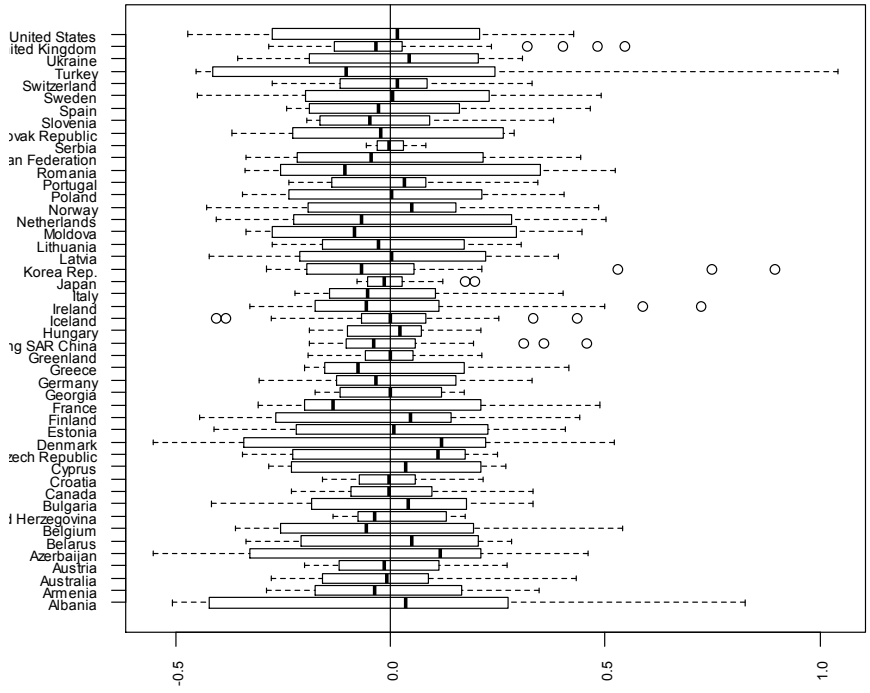


Figure 4.4:

Instead, I start from from the general panel model:

$$y_{it} = \alpha_{it} + \boldsymbol{\beta}_{it}{}' x_{it} + u_{it} \qquad (4.6$$

Recognizing that u_{it} cannot be estimated with NxT datapoints, I will make a number of parameter homogeneity assumptions. $\alpha_{it} = \alpha, \forall i, t$ and $\beta_{it} = \beta, \forall i, t$. To model country level heterogeneity, we can split the error term u_{it} into two parts, one country-specific which I will assume is invariant across t, μ_i while the second is the remaining noise term ϵ_{it} with a standard normal distribution, with $\epsilon_{it} \perp x_{it} \wedge \epsilon_{it} \perp \mu_i$:

$$y_{it} = \alpha + \boldsymbol{\beta}' x_{it} + \mu_i + \epsilon_{it} \qquad (4.7$$

which is a *fixed effects* model where α, μ_i and the $\boldsymbol{\beta}$ must be estimated. If μ_i is assumed to be 0, we have a *pooling* model.

The assumptions that we must accept in order to perform this estimations are rather strong, so let us evaluate another possibility, first-differencing the data:

$$\Delta y_{it} = \alpha + \boldsymbol{\beta}' \Delta x_{it} + \mu_i + \Delta \epsilon_{it} \qquad (4.8$$

where t=2,...T.

Lastly, the between model, which is computed on time (group) averages of the data, discardsall the information due to intragroup variability but is consistent in some settings (e.g., non-stationarity) where the others are not, and is often preferred to estimate long-run relationships.

For the calculating the estimators, I use a version of the *plm* package (Croissant and Millo 2008). Due to the collinearity complications discussed at the start of this chapter, I calculate have split the determinants into two set of estimators, to be calculated separately.

"Between"	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	7.7350	3.2028	2.4151	0.0254
SurvSelf	0.4597	0.2153	2.1354	0.0453
GDPSpendFam	0.0476	0.0655	0.7272	0.4755
TradRat	-0.3309	0.1340	-2.4698	0.0226
lnGDP	-1.3275	0.7146	-1.8576	0.0780
LFP	-0.0042	0.0084	-0.5025	0.6208
EducFemTer	-0.0006	0.0037	-0.1675	0.8687
Unempl	-0.0321	0.0190	-1.6902	0.1065
R^2=48.9%				

Table 4.4: Main between country estimation table.

"Within"	Estimate	Std. Error	t-value	Pr(>|t|)
SurvSelf	-0.0987	0.0575	-1.7165	0.0866
TradRat	-0.2956	0.0598	-4.9456	0.0000
EducFemTer	-0.0176	0.0019	-9.3539	0.0000
BirthOutWed	0.0021	0.0016	1.2797	0.2012
Unempl	-0.0068	0.0023	-3.0209	0.0026
MeanFirstMarr	-0.0098	0.0118	-0.8240	0.4103
EducFemTer:LFP	0.0003	0.0000	9.6509	0.0000
R-sq= 0.39, F=52.6, p-value: < 2.22e-16				

"Pooling"	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	1.6783	0.1354	12.3978	0.0000
SurvSelf	0.1866	0.0217	8.5927	0.0000
TradRat	-0.2618	0.0183	-14.3265	0.0000
EducFemTer	-0.0141	0.0015	-9.6508	0.0000
BirthOutWed	0.0036	0.0007	4.8254	0.0000
Unempl	-0.0022	0.0020	-1.0668	0.2865
MeanFirstMarr	0.0016	0.0056	0.2846	0.7761
EducFemTer:LFP	0.0002	0.0000	7.7491	0.0000
R-sq=0.53, F= 99.5, p-value < 2.22e-16				

Table 4.5: Beta estimators for the Fixed Effects and a Pooling model. Adj. R-Squared = 0.55268 F-statistic: 92.9001 on 8 and 581 DF, p-value: < 2.22e-16. In the first model the "Country" variable is treated as a fixed effect, in the second the effects are pooled (assume to be equal for all countries)

Armenia	Australia	Austria
1.93	2.28	1.89
Azerbaijan	Belgium	Bulgaria
2.49	2.27	1.82
Canada	Croatia	Cyprus
1.83	2.12	1.70
Czech R	Denmark	Estonia
1.91	2.24	1.91
Finland	France	Georgia
2.31	2.51	1.63
Germany	Greece	Hungary
2.04	2.08	1.94
Iceland	Ireland	Italy
2.16	2.42	1.97
Japan	Korea	Latvia
2.19	1.88	1.75
Lithuania	Moldova	Netherlands
1.85	1.83	2.25
Norway	Poland	Portugal
2.30	1.78	1.72
Romania	Slovakia	Slovenia
1.52	1.81	1.83
Spain	Sweden	Switzerland
2.05	2.34	1.92
Ukraine	United Kingdom	United States
1.70	2.20	2.12

Table 4.6: Country Fixed Effects Estimates for the "Within" Fixed Effects model

In Table 4.5, I present two sets of $\hat{\beta}$ estimators using the two different methods discussed above. The Table 4.6 lists the $\widehat{\mu_i}$ for the "within" fixed effects estimator. I have added the information for the pooling estimator to illustrate the pitfalls of not taking into account fixed country effects. As shown above, the "pooling" estimator assumes that all country-fixed effects are equal (can be pooled). This results in severe model misspecification. I test for this using an F-test for individual (in our case country level) effects, with F = 24.59, df1 = 38, df2 = 544, p-value < 2.2e-16, where H0: There are no significant effects, The p-value leads us to reject the null, and indicates that country-level

effects are highly significant. Checking against the Fixed effects table, we find a lot of variation, from over 2.5 to about 1.5, with the standard deviation at 0.25. The choice between fixed and random effects[2] specifications is based on Hausman-type tests, comparing the two estimators under the null of no significant difference: if this is not rejected, the more efficient random effects estimator is chosen. With chisq = 22.9099, df = 7, p-value = 0.001767, the null is rejected, and a fixed effects model is prefered.

How did the hypotheses from Chapter 3 fare under the fixed effects model?

Hypothesis	Statement of hypothesis	Test Result
H1a	Unemployment has a negative impact on TFR.	Confirmed at p=1%
H1d	Among advanced industrial countries, there will be a positive relationship between high tertiary enrollment rates for women and fertility rates.	Rejected at 0.01%
H1e	The interaction of tertiary enrollment for women and female labor force participation should be positively associated with TFR.	Confirmed at p=1%
H1f	A later mean age at first marriage should result in a decreased fertility rate.	Not significant
H1g	A higher rate of children born out of wedlock as a percentage of the total number of children	Not significant
H3a	Higher Traditional/Rational scores will be associated with lower levels of fertility.	Confirmed at p=1%
H3b	Along the Survival/Self-expression cultural axis, increasing Self-Expression values are negatively related to TFR levels.	Confirmed at p=10%, not significant at 5%
H3c	Above a certain threshold value, the relationship between Survival/Self-Expression values and TFR becomes positive, while the relationship is negative below it.	Rejected at 5%

[2] I did not include the random effects model in the paper but I calculated the estimates and rejected it after a Hausman test. For more information see source code in Appendix

Australia	Austria	Belgium	Canada
2.13	1.45	2.29	1.68
Czech	Denmark	Estonia	Finland
0.94	1.71	1.06	1.30
France	Germany	Greece	Hungary
1.92	1.51	1.23	1.01
Iceland	Ireland	Italy	Japan
1.94	2.25	1.69	1.58
Netherlands	Norway	Poland	Portugal
2.31	2.05	1.04	1.06
Slovakia	Slovenia	Spain	Sweden
0.68	0.69	1.58	1.72
Switzerland	Turkey	UK	USA
1.81	2.85	2.21	2.02

Table 4.7: Estimates for country fixed effects, model 2

Again, I test whether a fixed effects model is the most appropriate specification using an F test for individual effects. The results (F = 101.9901, df1 = 27, df2 = 421, p-value < 2.2e-16) allow us to again reject a pooling model as miss-specified (in effect a pooling model is similar on an ordinary least squares model)

"Within"	Estimate	Std. Error	t-value	Pr(>|t|)
GDPSpendFam	0.0341	0.0206	1.6578	0.0980
FPartTime	-0.0073	0.0022	-3.3999	0.0007
LFP	0.0230	0.0032	7.2326	0.0000
Urban	-0.0064	0.0042	-1.5325	0.1261
lnGDP	-1.0924	0.1374	-7.9474	0.0000
GDPSpendFam:SurvSelf	0.0457	0.0201	2.2752	0.0234
R-sq=.20, F=18.2 p<0.00001				

Table 4.8: Estimators for second regression

Hypothesis	Statement of hypothesis	Test Result
H1a	Unemployment has a negative impact on TFR.	Confirmed at p=1%
H1b	Contrary to the worldwide trend where per capita GDP is negatively associated with TFR, among the subset of richer countries in the OECD group, higher GDP per capita should be associated with higher TFR.	Rejected at 0.001%
H1c	Among the sample OECD members, female labor force participation is associated with higher TFR.	Significant at 0.001%
H1d	Among advanced industrial countries, there will be a positive relationship between high tertiary enrollment rates for women and fertility rates.	Rejected at 0.01%
H1e	The interaction of tertiary enrollment for women and female labor force participation should be positively associated with TFR.	Confirmed at p=1%
H1f	A later mean age at first marriage should result in a decreased fertility rate.	Not significant
H1g	A higher rate of children born out of wedlock as a percentage of the total number of children	Not significant
H1h	Increased urbanization will have a detrimental effect on TFR.	Not significant
H2a	Social spending on families by the Government is associated with higher rates of fertility.	Significant at 5% only in the context of high SurvSelf values
H2b	Increased prevalence of female part time employment has a positive effect on TFR	Rejected at 0.001%
H3a	Higher Traditional/Rational scores will be associated with lower levels of fertility.	Confirmed at p=1%
H3b	Along the Survival/Self-expression cultural axis, increasing Self-Expression values are negatively related to TFR levels.	Confirmed at p=10%, not significant at 5%
H3c	Above a certain threshold value, the relationship between Survival/Self-Expression values and TFR becomes positive, while the relationship is negative below it.	Positive and significant at 5% when associated with high Family Spending by Government

The results from testing the hypotheses still leave us with one important question. It appears that Government spending for the social welfare of families as a percentage of GDP is only significant when associated with Survival-Self-expression values. What is the causal relationship here? Government largesse, especially in the form of social welfare, could create a sense of security and encourage people to abandon Survival values and, taking their continued survival for granted, embrace Self-Expression values. Alternatively, we know that one of the dimensions of Self-Expression is increased readiness to engage in political action, such as signing petitions and pressuring politicians. It could be that increased Self-Expression values have *caused* people to demand more of their government.

"within"	Estimate	Std. Error	t-value	Pr(>|t|)
lag(GDPSpendFam, 5)	0.401044	0.042838	9.361959	5.24E-19
lag(TradRat, 5)	0.311933	0.174243	1.79022	0.074156
lag(SurvSelf, 5)	0.29295	0.09833	2.979246	0.003061
R-sq=.20, F=38, p<.000001				

Table 4.9: Survival-Self Expression values predict changes in Social spending for Families by the Government 5 years later. The size of the effect is significant

As we can see in Table 4.9, Survival-Self expression values predict changes in Family-related social spending 5 years later, even when a measure of lagged spending is introduced into the model. The hypothesis that values cause spending cannot be rejected at this time, but far more work would be required to actually establish causation.

Chapter 5

Conclusions

At the conclusion of an extensive empirical testing of the literature on total fertility rates, what have we found out?

The evidence has allowed us to reject a number of causative models:

1. When controlling for other factors, there does not seem to be any shift towards a positive relationship between GDP per capita and Total Fertility Rates. The relationship appears strongly negative. Changes in income, by itself, when accounting for fixed effects remains strongly negative. This result may be in part caused by the presence of several poor countries still undergoing the first fertility transition at the start of the time-series, and undergoing rapid fertility decline and as well as achieving significant gains in GDP per capita.
2. .The direct relationship between tertiary enrollment and fertility rates was actually found to be significantly negative. Each 10% increase in tertiary enrollment is associated with a fertility decline of 0.1 children. Even in the analysis of the most recent data in Chapter 3 the relationship was not positive. Admittedly, the data I use goes back to 1980, and Esping-Andersen's claim is

that the change is of a more recent nature, and part of the causation story she told was that of an interaction effect with female labor participation.

3. There seems to be no significant relationship between the mean age of marriage or the proportion of children born out of wedlock and fertility rates. Data on the rate of cohabitation at the time the child is born would probably serve a useful purpose, separating the couples who live as if they were married without actually going through the formalities from the true single mothers.
4. The presumed positive causal mechanism behind female part time employment and TFR has not been borne out by the data. Whether this is because of the confounders described in Chapter 3 or because there truly is no relationship between TFR and the availability of flexible part time positions remains to be seen. I the future, I plan to collect better data on workplace flexibility, that is, the ability of workers to set their own hours.

There are also a number of hypotheses I was unable to reject on the basis of available evidence:

1. I was unable to reject the idea that Survival-Self-Expression values are negatively related to fertility, except in the context where they are paired with high social security spending. Interestingly, social security spending in the absence of high self-expression orientation in the population was shown in the analysis in the previous chapter to be ineffective. This might explain the puzzling situation of Germany, where high social spending on families and lowest of the low fertility rates coexisted for years. Issues of collinearity

prevented a full test against all other variables, but I have provided the full test in the Appendix, and the direct relationship remains negative and significant, while the positive relationship intermediated through Government spending on families also remains positive and highly significant, even in the context of high collinearity noise.

2. I was also unable to reject the hypothesis that Rational-Secular values are strong predictors of low fertility. A shift from 0 (about where the United States is located right now) to 1 (about where Germany is on the Traditional-Rational secular axis) corresponds to a 0.3 decrease in total fertility rates, even when controlling for other determinants. Issues of collinearity prevented a full empirical test.
3. There was no evidence on the basis on which to reject the hypothesis that there is an interaction between tertiary enrollment and labor force participation. One could read this in the context of the previous discussion on Esping-Andersen, and argue that highly educated women enter the labor force at a high wage rate and soon become established enough in their careers that the prospect of having children does not seem so daunting, at least from a financial security perspective.
4. I was also unable to reject the simpler hypothesis that higher overall female labor force participation rates are linked to higher fertility. The discussion in chapter three suggests that either increased financial security derived from having two wage earners is the causal path, or perhaps that low levels of labor force participation are associated with very restrictive labor environments for

women, and each temporary exit from the labor force might make reentry problematic in the future, prompting many women to decrease the total number of children they have.

5. In line with the Inglehart existential security story, increased unemployment is highly correlated with decreased fertility. This finding, just like the cultural values discussed before, has been tested in R with the *perturb* package which introduces noise in to the dataset. Being stuck at home without a job appears to be a powerful anaphrodisiac.

Further study and more evidence will be needed before I will claim that any policy implications can be derived from this work. Even so, it does provide partial answers to some vexing questions? Why is social spending on families in Germany and Central Europe so ineffective? It seems that values play an important role. For rich, low fertility countries, the conclusion of this study is a dismal one, then. No quick solutions are in sight. As the rich world continues its slow transition towards ever rising levels of secularism, questions of sustainability will become more and more prevalent. The Nordic path, of high social security spending, seems to negate, in part the negative fertility effects of modernization. But even so, as societies age and elderly dependency ratios increase, the burden of such spending might become unbearable even for the Nordic democracies. Moreover, as comparatively poor and ill-governed middle-income economies collapse towards sub-replacement fertility at a pace much faster than the gentle decline so far seen in Europe, it is unclear that these new, poor graying countries

have either the administrative or the financial wherewithal to promote and sustain across decades Nordic levels of government engagement and spending.

A lot of work remains to be done. There is a lot to expand and revise in this work. Primarily, this will involve painstaking data gathering, going beyond what is available in current databases. I found it perplexing that no data on workplace flexibility seems to be in the public domain, or even accessible via the university's system, even with the help of research librarians. If possible, I plan to build such a dataset and make it publicly available. Much more work is needed on the political side of this issue. I plan to gather data on child and family welfare legislation passed at the national level and aggregate it to produce a more refined tool that a brute percent of GDP spending level I was forced to use for the current work. In what political context are these laws passed? Is it nationalism or xenophobia? Mere fiscal prudence and commendable farsightedness? How do multi-decadal fertility policies get implemented by democratic politicians with short time horizons? In many countries, pro-birth policies bring back dark memories of fascist policies or eugenic practices - even Sweden practiced forced sterilization at some point! Is this a serious impediment or merely a convenient excuse?

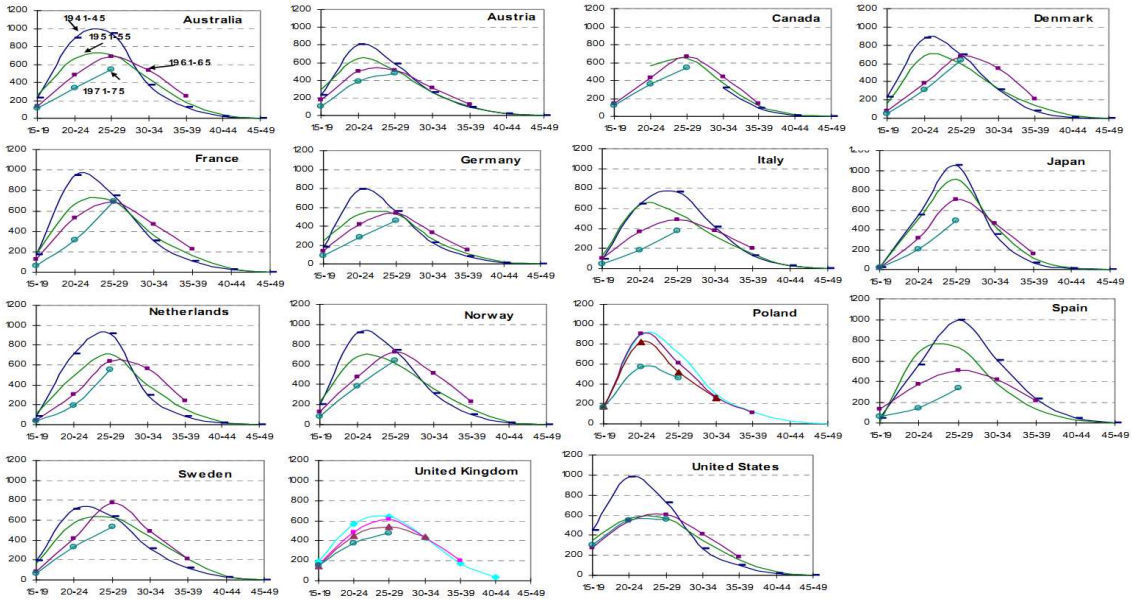
Finally, I plan to expand my focus to encompass the rapidly transitioning lower-middle income economies and examine their options for dealing with the coming demographic storm. Perhaps the doom-mongers predicting demographic collapse are on to something this time. And if not, well, debunking prophesies of doom is always fun.

Appendix

	Estimate	Std. Error	t-value	Pr(>|t|)
GDPSpendFam	0.0025	0.0301	0.0821	0.9346
FPartTime	-0.0102	0.0031	-3.2526	0.0012
LFP	0.0042	0.0050	0.8487	0.3966
Urban	0.0123	0.0053	2.2986	0.0221
lnGDP	-1.7821	0.2138	-8.3351	0.0000
SurvSelf	-0.4478	0.1047	-4.2753	0.0000
TradRat	-0.0639	0.0626	-1.0198	0.3085
EducFemTer	-0.0010	0.0027	-0.3794	0.7046
BirthOutWed	0.0042	0.0019	2.2118	0.0276
Unempl	-0.0175	0.0029	-6.1447	0.0000
MeanFirstMarr	0.0546	0.0135	4.0353	0.0001
GDPSpendFam:SurvSelf	0.0710	0.0358	1.9816	0.0483
LFP:EducFemTer	0.00002	0.0000	0.5276	0.5981
R-sq=.33, F=14.2 p<0.00001				

Country	Estimate	Std. Error	t value	Pr(>|t|)
Albania	2.640867	0.055451	47.62544	0.000
Armenia	2.100667	0.055451	37.88346	0.000
Australia	1.842	0.055451	33.21866	0.000
Austria	1.446667	0.055451	26.08921	0.000
Azerbaijan	2.499637	0.055451	45.07849	0.000
Belarus	1.623	0.055451	29.26921	0.000
Belgium	1.636667	0.055451	29.51568	0.000
Bosnia and Herzegovina	1.59	0.055451	28.67409	0.000
Bulgaria	1.564333	0.055451	28.21122	0.000
Canada	1.61931	0.056399	28.71184	0.000
Croatia	1.582667	0.055451	28.54184	0.000
Cyprus	2.059	0.055451	37.13204	0.000
Czech Republic	1.568333	0.055451	28.28335	0.000
Denmark	1.674333	0.055451	30.19496	0.000
Estonia	1.707333	0.055451	30.79008	0.000
Finland	1.748	0.055451	31.52346	0.000
France	1.840333	0.055451	33.1886	0.000
Georgia	1.923667	0.055451	34.69144	0.000
Germany	1.359	0.055451	24.50823	0.000
Greece	1.487667	0.055451	26.82861	0.000
Greenland	2.4105	0.067913	35.49392	0.000
Hong Kong SAR China	1.267	0.055451	22.8491	0.000
Hungary	1.571333	0.055451	28.33745	0.000
Iceland	2.121333	0.055451	38.25616	0.000
Ireland	2.178667	0.055451	39.29011	0.000
Italy	1.335333	0.055451	24.08143	0.000
Japan	1.500333	0.055451	27.05704	0.000
Korea Rep.	1.607667	0.055451	28.99269	0.000
Latvia	1.589667	0.055451	28.66808	0.000
Lithuania	1.685333	0.055451	30.39333	0.000
Moldova	2.015	0.055451	36.33855	0.000
Netherlands	1.617	0.055451	29.16101	0.000
Norway	1.822333	0.055451	32.86399	0.000
Poland	1.757	0.055451	31.68577	0.000
Portugal	1.566	0.055451	28.24127	0.000
Romania	1.674	0.055451	30.18895	0.000
Russian Federation	1.607333	0.055451	28.98668	0.000
Serbia	1.702069	0.056399	30.17922	0.000
Slovak Republic	1.716	0.055451	30.94638	0.000
Slovenia	1.477667	0.055451	26.64827	0.000
Spain	1.426667	0.055451	25.72853	0.000
Sweden	1.776333	0.055451	32.03443	0.000
Switzerland	1.497667	0.055451	27.00895	0.000
Turkey	2.838	0.056399	50.3203	0.000
Ukraine	1.581667	0.055451	28.52381	0.000
United Kingdom	1.782	0.055451	32.13662	0.000
United States	1.977333	0.055451	35.65927	0.000

0.1 Parameter estimates for County Fixed Effects Model


Australia
1941-45
1951-55
1961-65
1971-75
Austria
Canada
Denmark
France
Germany
Italy
Japan
Netherlands
Norway
Poland
Spain
Sweden
United Kingdom
United States
1200
1000
800
600
400
200
0
15-19
20-24
25-29
30-34
35-39
40-44
45-49

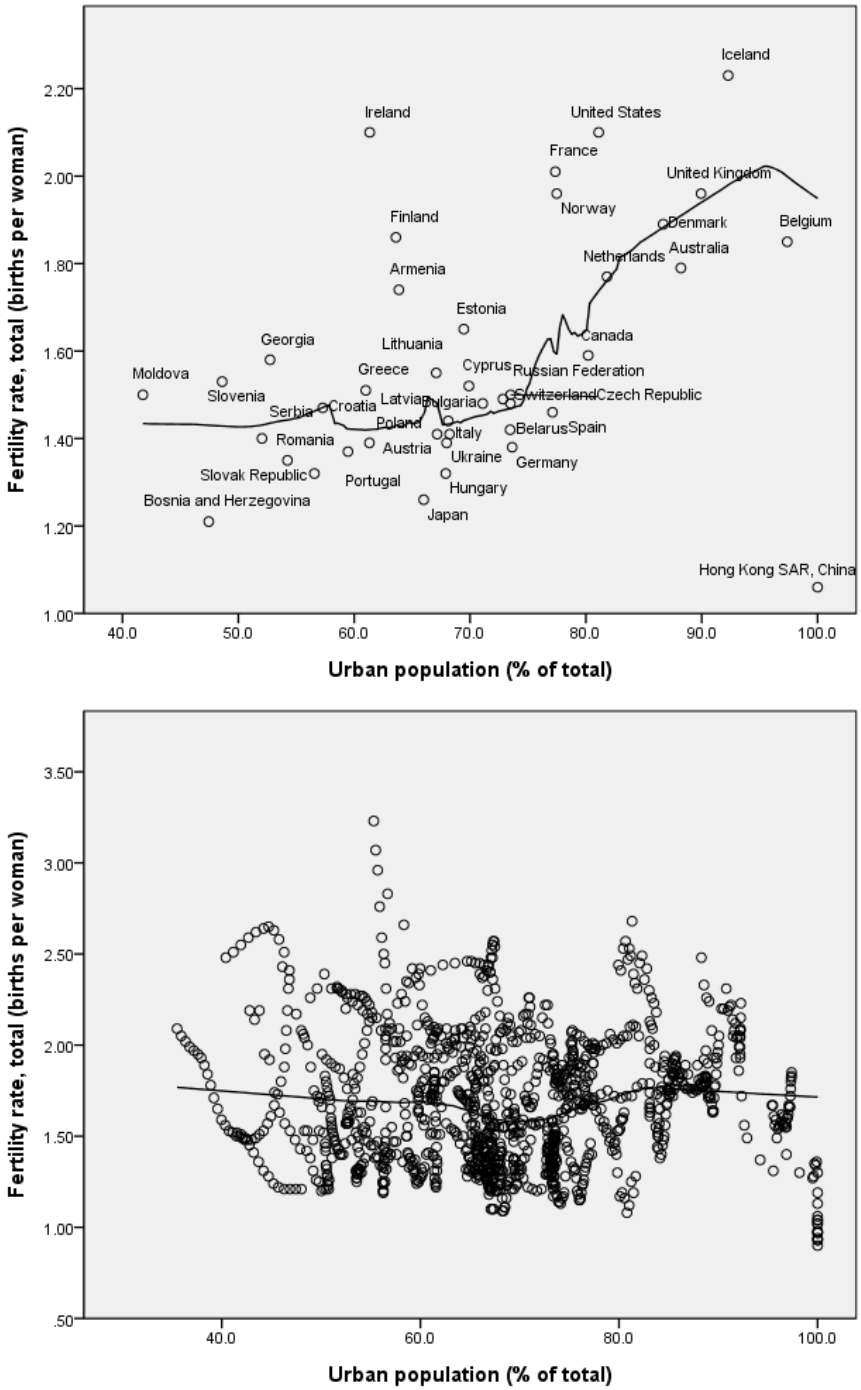
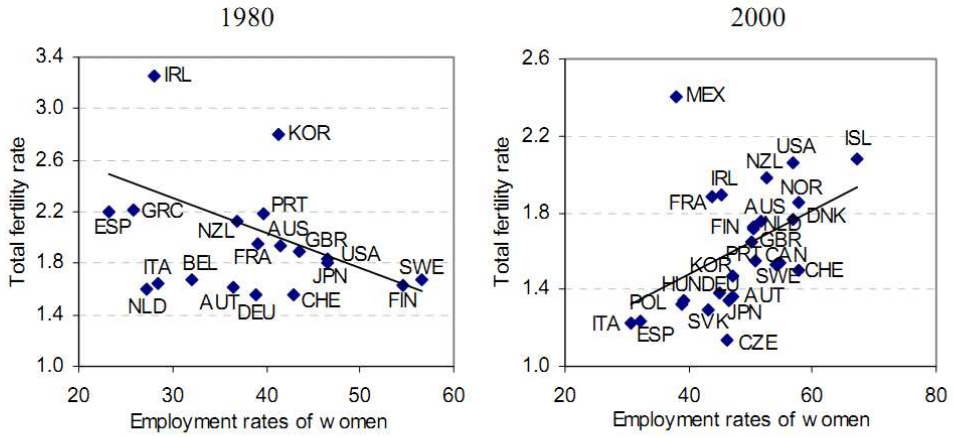
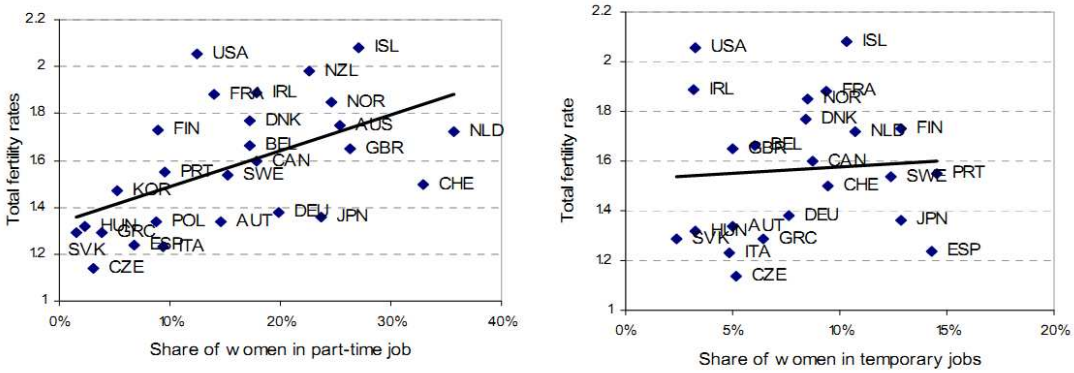


Figure 0.2: Urbanization and Fertility - The data for all years shows no trend, indicating that the positive relationship in the one year snapshot data is probably just a fluke.

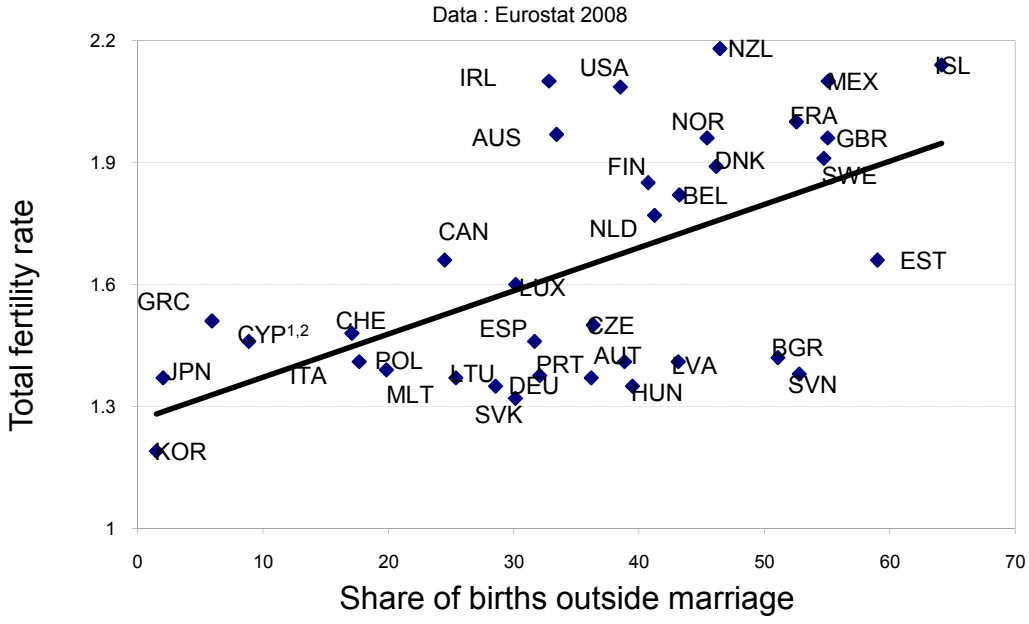


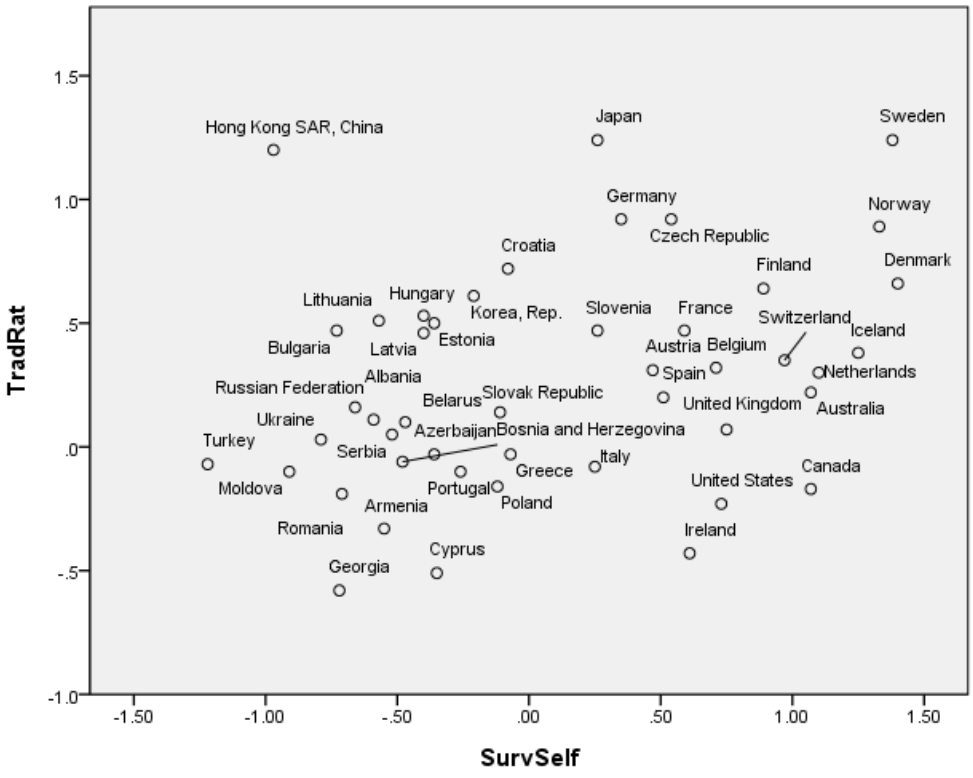
Note: Employment rates refer to women aged 15-64.

Source: Computations on data from *Society at a Glance – OECD Social Indicators* and OECD (2005a), Labour market indicators.



Source: Computations on data from *Society at a Glance – OECD Social Indicators* and OECD (2005), Labour market indicators.


Data : Eurostat 2008
Total fertility rate
Share of births outside marriage
2.2
1.9
1.6
1.3
1
0
10
20
30
40
50
60
70
NZL
ISL
IRL
USA
MEX
NOR
FRA
AUS
GBR
FIN
DNK
SWE
BEL
NLD
CAN
EST
LUX
GRC
CYP1,2
CHE
ESP
CZE
BGR
JPN
ITA
POL
PRT
AUT
LVA
LTU
DEU
HUN
SVN
MLT
SVK
KOR


TradRat
SurvSelf
1.5
1.0
.5
.0
-.5
-1.0
-1.50
-1.00
-.50
.00
.50
1.00
1.50
Hong Kong SAR, China
Japan
Sweden
Germany
Norway
Czech Republic
Croatia
Finland
Denmark
Lithuania
Hungary
Korea, Rep.
Slovenia
France
Switzerland
Iceland
Bulgaria
Latvia
Estonia
Austria
Belgium
Spain
Netherlands
Albania
Russian Federation
Slovak Republic
Belarus
United Kingdom
Australia
Ukraine
Azerbaijan
Bosnia and Herzegovina
Turkey
Serbia
Italy
Greece
Canada
United States
Moldova
Portugal
Poland
Armenia
Romania
Ireland
Cyprus
Georgia

	Governments' views on fertility levels:		
	Satisfactory	*Too low*	*Too high*
1976	Australia, Austria, Belgium, Canada, Switzerland, Denmark, Spain, United Kingdom, Hungary, Ireland, Iceland, Italy, Japan, Netherlands, Norway, New Zealand, Poland, Portugal, Sweden, United States	Finland, France, Greece, Luxembourg	Korea, Mexico, Turkey
1986	Australia, Austria, Belgium, Canada, Switzerland, Denmark, Spain, Finland, United Kingdom, Ireland, Iceland, Italy, Japan, Netherlands, Norway, New Zealand, Poland, Portugal, United States	France, Greece, Hungary, Luxembourg, Sweden	Korea, Mexico, Turkey
1996	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Spain, Finland, United Kingdom, Ireland, Iceland, Italy, Korea, Netherlands, Norway, New Zealand, Poland, Sweden, United States	Switzerland, Germany, France, Greece, Hungary, Japan, Luxembourg, Portugal, Slovak Republic	Mexico, Turkey
2003	Australia, Belgium, Canada, Denmark, Finland, United Kingdom, Ireland, Iceland, Netherlands, New Zealand, Sweden, United States	Austria, Switzerland, Czech Republic, Germany, Spain, France, Greece, Hungary, Italy, Japan, Korea, Luxembourg, Norway, Poland, Portugal, Slovak Republic	Mexico, Turkey

	Governments' policies on fertility levels			
	No intervention	*Maintain*	*Raise*	*Lower*
1976	Australia, Austria, Belgium, Canada, Switzerland, Denmark, Spain, United Kingdom, Iceland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Sweden, United States	Hungary, Ireland, Poland	Finland, France, Greece, Luxembourg	Korea, Mexico, Turkey
1986	Australia, Austria, Canada, Switzerland, Denmark, Spain, Finland, United Kingdom, Iceland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Sweden, United States	Belgium, Ireland, Poland	France, Greece, Hungary, Luxembourg	Korea, Mexico, Turkey
1996	Australia, Austria, Belgium, Canada, Switzerland, Czech Republic, Germany, Denmark, Spain, United Kingdom, Iceland, Italy, Japan, Korea, Netherlands, Norway, New Zealand, Poland, Portugal, Sweden, United States	Ireland	Finland, France, Greece, Hungary, Luxembourg, Slovak Republic	Mexico, Turkey
2003	Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, United Kingdom, Italy, Netherlands, Norway, New Zealand , Portugal, Sweden, United States	Australia, Ireland, Iceland	Austria, Czech Republic, France, Greece, Hungary, Japan, Korea, Luxembourg, Poland, Slovak Republic	Mexico, Turkey

Source: Data extracted from United Nations (2004), *World Population Policies 2003*.

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