The Economics of the Reproduction 'Crisis' in Transition Europe: The Effect of Shifts in Values, Income and Uncertainty (With Special Reference to Russia)

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Thesis submitted for the Ph.D

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"It is therefore worth while to search out the bounds between opinion and knowledge, and examine by what measures, in things whereof we have no certain knowledge, we ought to regulate our assent and moderate our persuasions".

John Locke 1689.

Abstract

This thesis investigates the causes for the abrupt, universal and virtually unprecedented decline in the total fertility rate in transition Europe. Using evidence from Russia, it tests two competing hypotheses on the fertility decline: the demographic and economic hypotheses. Empirical findings can be summarized as follows: I find insufficient support for the demographic hypothesis—the fertility decline in Russia cannot satisfactorily be explained by a simultaneous shift in values and attitudes towards reproduction and timing of births. In contrast, I provide preliminary cross-regional evidence to support the economic hypothesis—regions with the largest fall in (the proxy for) income and large uncertainty experienced the largest declines in the fertility rates. This result is consistent with Becker's economic model of reproductive behaviour, insofar as it establishes a positive relationship between changes in income and fertility. It however introduces an additional explanatory variable: people's perception of uncertainty. In a preliminary attempt to reconcile the standard economic model with these findings, a simple model of households' reproductive decision is developed. It shows that each household tends to postpone the decision for an incremental child, whenever there is widespread uncertainty. It suggests that, if the individual decision to procrastinate is replicated over a large number of households, it can lead to an aggregate, short-term fall in the fertility rate. Provided that conclusions for the transition European region can be drawn from the Russian evidence, this inquiry shows that fertility has declined in response to a lower income and higher uncertainty: it reflects the deterioration in the quality of life and a loss in welfare. Thus, it is a strong negative indicator of the transition process.

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CORRIGENDA

Page 39, line 24; again page 117, line 1 and line 22; again page 52, footnote 52: 'this paper' should be changed into 'this chapter'.

Page 48, line 7: 'increase' should be changed into 'decrease'.

Page 56, line 13. 'the cost and utility functions' should be changed into 'the costs and the utility function'.

Page 56, line 18: 'individual costs and utility functions' should be changed into 'individual costs and the utility function'.

Page 59, line 3: 'by a low level of fertility and mortality' should be changed into 'by low levels of fertility and mortality'.

Page 69, line 22: 'actual data only reflects' should be changed into 'actual data only reflect'.

Page 128, line 15: 'all the characteristics of regarding the perception of future income and job opportunities unemployed' should be changed into 'all the characteristics of the unemployed regarding the perception of future income and job opportunities'.

Page 171, line 21: Eatwell et al.: title should be in italics, rather than quotation marks.

Page 177, line 34; again page 186, line 24: Shapiro: title should be in quotation marks, rather than italics.

Page 178, line 24: title should read 'World Development Report 1997', not 'World Development Report 1987'.

Page 179, line 8: Fischer has a c in the middle.

Page 182, line 21: Ellman: title should be in quotation marks, rather than italics.

Page 184, line 3: title should read 'World Development Report 1997', not 'World Development Report 1996'.

I. General Introduction

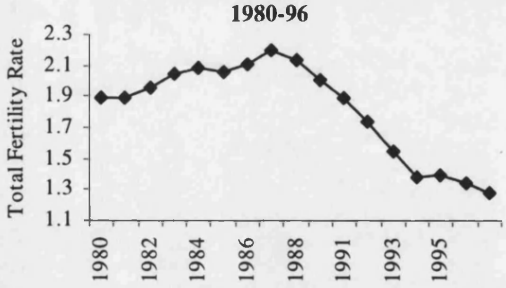
"The family is a remarkable institution. And a complex one. Indeed, so complex that much of economic theory proceeds as if no such thing exists."
Amartya Sen, 1983

1. Purposes of Inquiry

Central and Eastern Europe is experiencing what is widely perceived as a fertility 'crisis': an abrupt, unexpected and historically unprecedented drop in the total fertility rate. The recent pace of decline has only been known in the past during times of desperate privation. In some countries, the fertility fall was even larger than during the American fertility decline in the Great Depression. The deterioration in the total fertility rate ranks among the striking indicators of social development in the current decade, along with high unemployment, rising income inequality and poverty.

Each country of Central and East Europe has been hitherto looking at its own falling total fertility rate, considering it as an isolated national feature. Yet, a comparison across countries reveals that the fertility decline is universally repeated throughout the region[1]. All countries of the region, without a single exception, feature accelerated fertility declines. This common pattern distinguishes the falling fertility rate from, for example, the mortality rate. For Shapiro (1995, 1997), the recent upsurge of mortality in Russia has no other equivalent in the region[2].

Fig.1.1: Total Fertility Rate, Russia, 1980-96



Source: Goskomstat, 1996; INED, 1998

Fertility declines have markedly accelerated during the period of economic and political transition. Between 1990-1996, the total fertility rate declined between 22 percent (Poland) and 37 percent (Czech Republic) (UNICEF 1998). The total fertility rate (TFR)[3], which may be most easily understood as the present

[1] I thank the participants in the conference on "The Economics of Social Policy Choices" (1998) for having provided me with thoughtful comments supporting this.
[2] More precisely, mortality rose in most Central and Eastern European countries after 1989, but has hit the hardest in the FSU countries (UNICEF 1997). By 1995, the adverse mortality trends were almost all being reversed.
[3] The term 'total fertility rate' can be misleading for it actually represents a level and not a change. This inquiry focuses on the *variation* in the total fertility rate (or fertility rate in short).

projection of the completed family size based on current age-specific birth rates, is, across the region, well below the replacement level of 2.1 children per childbearing woman.

More startling is the finding that, even the most advanced countries in the process of economic transition, the so-called "successful reformers" of the *World Development Report* (World Bank 1996), such as Slovenia, Poland and the Czech Republic, are undergoing a rapid fertility decline as well. In Slovenia, we have the instructive case of a country having carried out far-reaching market reforms, enjoying steady economic growth for the last four years and a front-runner in the EU accession process with an infant mortality rate superior to that of the United States[4]. Yet, its fertility rate has fallen so sharply that it is now comparable to Russia (table 1.1).

Table 1.1: Total Fertility Rate: Russia, Slovenia and Selected Western European countries, 1985-95

	1985	1990	1995
Russia	**2.05**	**1.90**	**1.34**
Slovenia	**1.72**	**1.46**	**1.29**
Sweden	1.74	2.13	1.74
United Kingdom	1.79	1.84	1.71
France	1.81	1.78	1.70
Belgium	1.51	1.62	1.54
Germany	1.37	1.45	1.24
Greece	1.68	1.43	1.40
Spain	1.63	1.33	1.18
Italy	1.39	1.29	1.17

Source: INED, 1998.

In this thesis, I have chosen to concentrate empirically on the very sharp case of Russia. Of the whole region, Russia is experiencing one of the most severe deteriorations in fertility indicators. In 1996, the number of newly born children was a third less than six years earlier; the total fertility rate plummeted to 1.28 children per childbearing woman (INED 1998). For balance, the fertility rate levels of Western European countries, already considered by many demographers to be alarmingly low, is given in table 1.1.

The accelerated fertility declines to levels well below replacement, combined with stagnating or even declining mortality rate and increased net out-migration, indicates that Central and Eastern Europe is currently experiencing a net loss of population. Since 1990, population has declined in almost all countries of the region. In Russia, for example, the population shrunk by more than half a million between 1990 and 1996 (UNICEF 1998).

[4] I am grateful to Matjaz Hanzek from the Statistical Office of Slovenia for precious demographic information.

The reduction in the size of the population has undeniably major policy implications for the long term. The most significant implication is that Central and Eastern Europe may run out of a vital resource for the economy: people. This demographic trend may slow down the pace of innovation and technological change, and thus undermine future economic growth.

As a result, Central and Eastern Europe is 'catching up' with Western Europe in fertility rate terms. Yet, the prospect of getting closer to Western Europe may be far from desirable. Central Europe is likely to inherit similar demographic problems to Western Europe: a shrinking younger population with a growing proportion of older people. This "graying" trend implies that fewer workers will have to provide for the great army of the retired, for the young who are still being reared and educated, and for the still insoluble legions of the unemployed. This is likely to be a delayed time bomb for the 'European Welfare States'.

Technically, the decline in fertility could be reversed with a large immigration, particularly of ethnic minorities from higher fertility regions of the world. In many European countries, however, this is not considered as a viable policy option. The recent tide of immigrants is already causing social and political upheavals—notably in France, where the National Front has brought immigration to the centre of the political stage. More recently, the flow of Albanians in the Kosovo region is raising fears about ethnic balance and threats the political stability in the FYR of Macedonia.

In Central and Eastern Europe, some politicians have used the 'fertility crisis' to oppose the process of economic and political transition towards market economy and revive nationalistic feelings. In Russia, for example, opponents of market reforms nurtured the belief that "Russia is dying out" and there is "a (Western) conspiracy aimed at destroying the Russian State". The 'fertility crisis' is attributed to the 'shock therapy' administered to the economy—explicitly blaming over-zealous economic reforms, Western advisors and the international community.

Despite its significance and policy salience, the rapid fertility decline in Central and Eastern Europe has been neglected by economists. The purpose of the thesis is to obtain a better understanding of the factors that caused the sharp fall in the total fertility rate across Central and Eastern Europe. In particular, it will test two competing

hypotheses (demographic and economic) on the fertility decline, by using Russia as a focus[5].

2. Previous Research on the Subject

Despite half a century of investigation into the determinants of fertility change, the present state of knowledge cannot precisely identify the causes of the rapid fertility decline in Central and Eastern Europe, neither can it predict its future trajectory. There is virtually no literature to review on fertility changes in Central and Eastern Europe[6].

The conventional body of theories on reproductive behaviour gives little insight into this matter. On the one hand, demographic and sociological theories of fertility primarily focus on issues raised by 'high fertility countries', notably their negative consequences on economic growth (Livi-Bacci 1989). Very little attention has been devoted to problems of 'low fertility' countries and rapid changes in the total fertility rate. On the other hand, the economic theory of reproductive behaviour, due to Gary Becker, has failed to deliver unambiguous predictions. Among other issues, Becker's theory can not be falsified.

The failure to provide a single grand explanation on fertility change is probably ascribed to the complexity of the subject. Reproductive decisions are likely to be influenced by a complex series of contextual forces: economic, social, cultural, educational and political, as well as personal circumstances. These factors are neither fully independent of each other nor mutually exclusive: they overlap and interact. In his Nobel Prize lecture, Gary Becker (1996) expresses this complexity:

> "Writing a *Treatise on the Family* (1981) is the most difficult sustained intellectual effort I have undertaken... Trying to cover this broad subject required a degree of mental commitment over more than six years, during many nighttime as well as daytime hours, that left me intellectually and emotionally exhausted. In his autobiography, Bertrand Russell says that writing the *Principia Mathematica* used up so much of his mental powers that he was never again fit for really hard

[5] The context of the transition is interesting empirically for it is characterized by sharp changes in economic and demographic indicators. There is, however, nothing special about the transition context.

[6] With few exceptions. For example: Macura (1995), Vishnevsky (1996), Zakharov and Ivanova (1996).

intellectual work. It took about two years after finishing the *Treatise* to regain my intellectual zest..."

As a result, the field of reproductive behaviour is often dominated by popular perceptions about the causes of fertility decline. These received opinions however rank no higher than pure speculations. I will show below that this is especially true in the recent episode of rapid fertility declines in Central and Eastern Europe. Let me first replace this episode in its context.

For Central and Eastern Europe, the current decade was marked by radical political and economic transformation—the so-called "transition" process towards market-based systems. Initially, transition led to large economic dislocations, acute supply problems, uncontrolled inflation, institutional vacuums and political uncertainties. Its immediate effects on economic output and a wide range of welfare indicators were almost exclusively negative (UNICEF 1997)[7]. The transition in Eastern Europe has been more painful than in Central Europe. Slovenia and Poland have, for example, long recovered from the initial transition shock. Yet, there is still major uncertainty about the long term. On the whole, an increasing number of people in transition Europe face rising prospects of unemployment, income inequality, and poverty (Milanovic 1995).

In the literature on transition, it became conventional wisdom to attribute the 'fertility crisis' to this process of economic and political transition. In his study of the Eastern German 'fertility crisis', the leading German demographer, Nicholas Eberstadt (1994) summarizes his view:

> "If there are any lingering doubts as to whether Eastern Germany's unexpected and rapid transition from communism to a "social market economy" has been a time of shock and crisis for the general public of the former GDR, they should be dispelled by the region's demographic trends...For populations that have known only the planned economy and the closed society, transition to the liberal market order might be expected to entail far-reaching, often traumatic, adjustments. Eastern Germany's demographic data document dramatic, unexpected, and in many ways unprecedented adjustments by the local populace to their new socioeconomic environment".

[7] Appendix 1.1 shows welfare indicators for selected Central and Eastern European countries.

The Russian demographer Khodov (1995) goes even further: he asserts that, not only market reforms but the market itself contributed to the 'fertility crisis' in Russia:

> "it is becoming ever clearer that the market is always against children...the market is killing babies: both those already born and those expected. Not only inflation but the market itself, the system with all its attributes."

A closer look at the evidence provided to support those views quickly reveals obvious weaknesses. Both authors roughly approximate the start of the rapid fertility decline to the initiation of transition, and the introduction of market reforms. In Russia, at least, I will show that this is not the case. Moreover, both authors remain silent on the mechanisms through which transition may have affected reproductive decisions. Is it for example, the deterioration in living standards (and the increase in the opportunity cost of children)? A shift towards modern Western individualistic values? Another shift in the incentives structure? The lack of new flats? Broad uncertainty associated with rising unemployment?

In this thesis, I choose to investigate two particular mechanisms of transmission. The choice of those mechanisms is based on the fact that they represent popular perceptions of the fertility decline, and have been widely used in the literature on transition as proven hypotheses. These are: 1) a shift in values that altered the fundamental attitudes towards reproduction, and 2) a fall in individual income that forced households to have fewer children.

1. Under the first mechanism, fertility fell in response to the spread of Western individualistic values to the East that accompanied the transition process. In the process of rapid 'adaptation' towards Western fertility levels, a new system of values and attitudes emerged. This system features a greater emphasis on individualism and a lesser desire for children. The decline in fertility is considered as a positive, long-term indicator of development[8]. This is referred to as the demographic hypothesis.

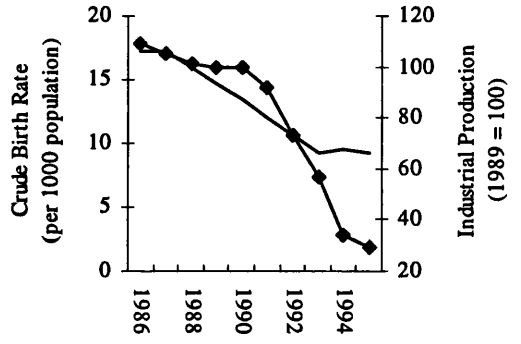
[8] This is a simplified interpretation of the demographic model. In fact, demographers are concerned with fertility decline (and refer to a 'fertility crisis') whenever there is a *sharp* variation in the TFR and the fertility rate falls below *replacement level.* I am grateful to demographers at the Economic Commission for Europe for this point.

2. Under the second mechanism, fertility fell in response to the economic crisis in general, and the deterioration in income in particular, that accompanied the transition process. Households wanted as many children as before the transition, but they could not afford them because their income had shrunk. The decline in fertility reflects therefore the deterioration in the quality of life and happiness. In other words, it is a strong negative, short-term indicator of the process of transition. This is referred to as the economic hypothesis.

The extent to which the economic crisis has influenced downturns in fertility is far from obvious. I now briefly illustrate with two countries, Russia and Slovenia why the economic explanation of the fertility decline requires more thorough investigation.

Figure 1.2 plots the crude birth rate (a crude measure of fertility)[9] and the volume of industrial production (a proxy for income[10]) for Russia. As shown, both (the proxy for) income and the crude birth rate, fell for a while, in parallel: this suggests that (the proxy for) income and the crude birth rate are related to one another. But a closer look at the timing of the decline reveals a much more complex story: the crude birth rate started to fall around 1986, about 3 years *before* the (proxy for) income started to collapse (Vandycke 1996a).

Fig.1.2 Birth Rate and Volume of Industrial Production, Russia, 1986-95



Source: Goskomstat, 1996; INED, 1998

Slovenia shows the opposite state: the total fertility rate has been continuously falling since 1990 while aggregate income has been steadily growing. Since 1995, Slovenia has made substantial advances in market reforms and shows impressive economic annual growth rates of about 5 percent (Hanzek 1998). In total, the Slovenian rapid fertility decline cannot entirely be explained by the fall in aggregate income.

[9] Appendix 1.2 examines alternative measures of fertility. Appendix 1.3 discusses the extent to which changes in the total fertility rate (TFR) adequately reflect changes in attitudes towards reproductive choice.

[10] As will be discussed in Chapter IV, the volume of industrial production can be considered as a better proxy for income than GDP or household income.

3. Methods of the Present Study

This inquiry investigates the causes for the rapid fall of the total fertility rate in Central and Eastern Europe, using the Russian experience as a focus. I now expose how I am pursuing the subject through the central use of comparative analysis, econometric tools, a theoretical model and an interdisciplinary approach.

I start by analyzing the most important theories on the causes of fertility change (Chapter II). I show that there are three approaches to the topic, i.e. economic, sociological and demographic, with each of them talking at cross-purposes. In seeking to bridge the disciplinary gap, I clarify the hypotheses underlying each approach. This comparative analysis helps to understand the fundamental differences between economic and demographic theories of reproductive choice.

I test the demographic and economic hypotheses on the rapid fertility decline in transition Europe (Chapters III and IV). I first test whether the rapid fertility decline is due to a shift in values and a change in attitudes towards reproduction. Then, I test whether the rapid fertility decline is due to the fall in income and increased uncertainty.

I use two types of data: 1) time-series fertility data are used to explore the behaviour of fertility over a long period of time and 2) cross-regional income and fertility data are used to explore possible explanatory factors.

To test the above hypotheses, I apply econometric techniques[11]. Because of the complexity of the issues at stake, I make use of sophisticated testing tools. The most complex of all, stochastic (unit root) analysis, is useful to study the behaviour of variables over time. Structural break analysis is used to detect an abrupt change in the evolution of a variable over time. Equipped with these powerful tools, I can show, for example, that in Russia, the most significant change in the total fertility rate (TFR) did not take place at the start of market reforms (1992): the decline in the TFR accelerated *before* 1992. Standard regression analysis is applied on regional fertility data.

As I indicated above, I use evidence from the Russian Federation. The choice of Russia as a reference case is based on four motives: first, the fertility decline in Russia

[11] Standard Ordinary-Least Square (OLS) method is used for regressions. The quantitative software used in this inquiry is Econometric Views.

offers a fresh example that has received little attention. Second, it illustrates the most startling changes connected to transition. The variation in both economic and demographic indicators is so sharp that it leaves little doubt as to whether there is an interesting issue to investigate. In Russia, for example, real GDP fell by 42 percent between 1989 and 1997 (UNECE 1998).

Third, the vast Russian State provides the richest illustration of striking regional differences. This will be a particularly useful characteristic for empirical testing. For example, I will show that, in the regions where the fall in (the proxy for) income was the largest, fertility rates fell the most. The study of the regional dimension of the fertility decline is an original contribution of this inquiry. Finally, Russia is the case that I know best, having spent time there, worked there briefly and having continued good contacts with demographers and economists there.

This inquiry is based on fertility data that I collected in Moscow and Paris. I obtained unpublished official data from the Russian Statistical Office, Goskomstat. At the time, the department in charge of regional data was compiling regional birth rate registration data for the 1989-95 period. I returned to original records in Goskomstat's archives to obtain information on earlier periods. I gathered information for all regions of Russia for the 1980s. I compiled these cross-section (regional) and time series data in a single database.

It is at the Centre for Human Ecology and Demography, the demographic institute of the Russian Academy of Sciences, that I found more sophisticated demographic information[12]. Their French collaborators at the Institut National d'Etudes Démographiques in Paris provided me with the missing registration data series.

Economic and demographic information for the rest of transition Europe was obtained from the Economic Commission for Europe and the International Child Development Centre.

Finally, in a modest contribution, I reconcile my empirical findings and the economic theory of reproductive behaviour. I model the reproductive decision process under 'broad uncertainty'. The model shows that the lack of confidence in tomorrow can

[12] The research institute includes leading Russian demographers notably Dr. Anatoly G. Vishnevsky, the Director, and Sergei V. Zhakarov, the leading specialist on Russian population reproduction, both of whom have outstanding international reputation and collaborative links.

lead households to postpone the decision of having an additional child to a later date. I suggest that this model can give insight into the rapid fertility decline in Slovenia.

This inquiry offers a good opportunity to re-establish a link between economics and sociology/demography in the area of reproductive behaviour. The social sciences locus is the fundamental understanding of human society. Also, the process of reproduction and variation over time arises as an essential concern of those disciplines.

My investigation lies on the borders between economics and other social sciences, and is deliberately interdisciplinary. Indeed, one of my earliest findings has been that the absence of such a broad approach is handicapping progress in understanding development in this field. I hope that the interdisciplinary approach I adopt will shed some light on this area of fundamental interest to economics, sociology and demography.

My interest in social issues[13] and the social impact of transition in particular was fostered over the past eight years. It all started with a profound interest in macroeconomics and a tenacious curiosity for Central and Eastern Europe. At the International Monetary Fund first and later at the World Bank, I became involved in the design and negotiation with government officials of macroeconomic stabilization programs in those countries. The interaction with government officials played a vital role in my understanding of transition. It gave me a unique opportunity to witness very closely political and economic developments of transition. But, more importantly, as an economist, it enlarged my vision of the transition with a new emphasis on the social consequences of the process of economic reforms.

[13] I recently gave a talk on the following topics: " Causes and Consequences of Wage Arrears in Russia" (Stockholm, May 1998) and "Employment in the European Union" (Tilburg, November 1997). I also participated in the seminar on "The Economics of Social Policy Choice" (Prague, February 1998).

4. Summary

Chapter II. In a comparison of the various approaches to the causes of fertility decline, I will clarify the hypotheses underlying the economic and demographic paradigms. I will show that, for economists, reproduction results from an individual and voluntarist decision. In contrast, for demographers, it is constrained by superior laws of Nature and a Darwinian selection process. For economists, reproductive behaviour can change in response to variations in both relative prices of children and income. For demographers, the cause for fertility change lies in a deeply rooted process of 'adaptation' of society towards a modern, Western equilibrium fertility level.

Chapter III. This chapter will develop and test a demographic hypothesis of the fertility decline, by using Russia as a focus. The hypothesis states that the rapid fertility decline in Russia results from two inter-linked processes. First, an accelerated adaptation towards Western fertility levels (the catching-up effect). This accelerated adaptation took place through a rapid change in attitudes towards reproduction. Second, a historical shift in the timing of births (the lagged-effect). Using time-series fertility Russian data, I will make two findings: first, the presence of a significant structural break in the fertility trend in 1989. Assuming that fertility trend reflects attitudes towards reproduction, this finding suggests a change in attitudes around 1989. Second, insufficient support to the demographic hypothesis. Specifically, I will fail to reject the stochastic model. This means that (almost all) fertility series behave randomly: they cannot simply be represented by a long-term deterministic breaking trend.

Chapter IV. This chapter will use standard OLS regression technique to test the extent to which the economic crisis has influenced downturns in the fertility rate. Using cross-section data for 66 regions of Russia (1990-95), I will find that regions with the largest fall in the total (and urban) fertility rate experienced the largest fall in (the proxy for) income and higher uncertainty. These findings challenge the simple economic explanation of the fertility decline, in which the deterioration in income explains the entire story. It shows that 'people's perception of uncertainty' increases the explanatory power of the regression model.

Chapter V. In a preliminary investigation, this chapter will explore the specific connection between reproductive decisions and uncertainty. It begins to show that 'broad uncertainty' is endemic to Central and Eastern Europe. It will then develop a small model

of reproductive decision. In this model, broad uncertainty undermines the household's capacity to process information: it perceives that the cost of doing something now is 'overly high', compared to doing it tomorrow. Under those assumptions, the household puts off the birth of the additional child. Also, I suggest that 'people's perception of uncertainty' can help explain why the fertility rate continued to fall in Slovenia (Poland or the Czech Republic), while aggregate income has been steadily growing. This chapter will show that the treatment of uncertainty in the economic theory of reproductive behaviour deserves more analysis.

Chapter VI will summarize each chapter and draw the policy implications of the inquiry. This investigation started with a concern about the social impact of the transition process in Central and Eastern Europe. Its purpose was to find out whether the rapid fall in the total fertility rate that was experienced throughout the region reflected a sharp deterioration in the quality of life and happiness. Based on Russian evidence, it will show that decline in the fertility rate represented the response to lower income and higher uncertainty (insecurity). As such, it can be interpreted as a strong negative indicator of the transition process.

Provided that conclusions can be drawn for the entire region on the basis of the Russian experience and the fertility decline is to be reversed, the investigation will conclude that 'successful reforms' have to be rapidly achieved. In particular, the following specific policy suggestions emerge as palliatives, although important ones, if the fertility decline is to end sooner rather than later:

1) Strong and rapid recovery of individual income is a priority for the entire region;
2) Provision of an adequate social safety net is needed to stabilize individual income and minimize the uncertainty surrounding future income. This is particularly important during the period of rapid economic transformation those countries have been experiencing.
3) After the turmoil of the first years of economic and political reforms, economic and political 'stabilization' is needed in the region. This process could help reverse the generalized lack of confidence in tomorrow that has characterized the transition process.

Appendix 1.1

Table 1.1.1

Welfare Indicators of Russia

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	1.6	-4	-5	-14.5	-8.7	-12.6	-4	-5
Annual inflation rate (%)		5.6	92.7	1526	875	307.4	197.7	47.7
Annual index of real wages (base=100)	100	109.1	102.4	68.9	69.1	63.7	45.9	52
Registered unemployment rate (%)			0.1	0.8	1.1	2.2	3.2	3.4
Demographic Indicators								
Total population (millions)	147.342	147.913	148.245	148.31	148.146	147.968	147.774	147.373
Share of children in total population (%)	27.2	27.1	27	26.7	26.4	26	25.7	25.2
Crude birth rate (per 1,000 pop.)	14.797	13.569	12.212	10.794	9.381	9.591	9.298	8.922
Crude death rate (per 1,000 pop.)	10.75	11.2	11.4	12.19	14.37	15.55	14.91	14.13
Female life expectancy at birth (years)	74.5	74.3	74.3	73.8	71.9	71.2	71.7	72.6
Male life expectancy at birth (years)	64.2	63.8	63.5	62	58.9	57.6	58.3	59.9
Maternal mortality (per 100,000 live births)	49.015	47.414	52.434	50.767	51.632	52.338	53.307	48.902
Net migration (thousands)	115.3	183.8	16.7	252.9	440.3	809.6	502.5	343.5
Reproductive Behaviour								
Total fertility rate	2.01	1.89	1.73	1.55	1.39	1.4	1.34	1.28
Share of births to unmarried mothers (%)	13.5	14.61	16.04	17.15	18.18	19.58	21.14	22.99
Share of births to teen mothers (%)	11.84	13.85	15.37	16.45	17.66	18.22	17.45	16.06
Abortion rate (per 100 live births)	204.93	206.32	201.07	216.47	235.24	217.32	202.84	203.28
Family Stability								
Crude marriage rate (per 1,000 pop.)	9.4	8.9	8.6	7.1	7.5	7.3	7.3	5.9
General divorce rate (per 100 marriages)	42.1	42.4	46.8	60.7	59.9	63	61.9	64.9
Children involved in divorce (thousands)	479.1	466.1	522.2	569.1	593.8	613.4	588.1	463.5
Child Welfare								
Infant mortality rate (per 1,000 live births)	17.8	17.4	17.8	18	19.9	18.6	17.6	17
Under 5 mortality rate	21.97	21.35	21.9	22.09	24.31	23.01	22.66	25
DPT immunisation rate (% children <2 yrs.)	82.7	68.5	68.7	72.6	79.2	88.1	92.7	95.1
Kindergarten enrolment rate (% 3-6 yrs.)	69.3	66.4	63.9	56.8	57.4	56.2	55.5	55
Basic school enrolment rate (% 7-15 yrs.)	93	93.6	94.4	93.3	91.9	90.7	91.3	91.4

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.2

Welfare Indicators of Slovenia

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	-0.5	-4.7	-8.9	-5.5	2.8	5.3	4.1	3.1
Annual inflation rate (%)		549.7	117.7	201.3	32.3	19.8	12.6	9.7
Annual index of real wages (base=100)	100	73.8	61.8	61.3	70.4	75.4	79.4	83.1
Registered unemployment rate (%)	2.9	4.7	8.2	11.5	14.4	14.4	14.1	13.9
Demographic Indicators								
Total population (millions)	1.996	1.998	1.999	1.996	1.992	1.989	1.99	1.989
Share of children in total population (%)	25.5	25.2	24.8	24.3	23.9	23.4	22.9	22.4
Crude birth rate (per 1,000 pop.)	11.816	11.244	10.848	10.064	9.985	9.836	9.581	9.501
Crude death rate (per 1,000 pop.)	9.35	9.29	9.66	9.68	10.05	9.73	9.53	9.36
Female life expectancy at birth (years)	76.67	77.28	77.38	77.25	77.29	77.38	76.76	78.25
Male life expectancy at birth (years)	68.8	69.43	69.54	69.45	69.4	69.58	70.27	70.79
Maternal mortality (per 100,000 live births)	4.265	0	4.633	5.005	10.105	10.276	5.269	
Net migration (thousands)	2.4	2.2	3.1	0.4	1.4	0.9	2.5	
Reproductive Behaviour								
Total fertility rate	1.52	1.46	1.42	1.34	1.34	1.32	1.29	1.28
Share of births to unmarried mothers (%)	23.25	24.54	26.42	27.67	27.97	28.77	29.81	31.85
Share of births to teen mothers (%)	8.15	7.81	7.04	7.03	5.93	5.36	5.14	4.31
Abortion rate (per 100 live births)	67.73	65.86	64.99	66.35	61.41	58.18	56.85	54.39
Family Stability								
Crude marriage rate (per 1,000 pop.)	4.9	4.3	4.1	4.6	4.5	4.2	4.1	3.8
General divorce rate (per 100 marriages)	22.1	21.8	22.4	21.6	21.7	23.1	19.2	26.5
Children involved in divorce (thousands)	2.1	2	1.9	2	2	2	1.5	2
Child Welfare								
Infant mortality rate (per 1,000 live births)	8.2	8.4	8.2	8.9	6.8	6.5	5.5	4.7
Under 5 mortality rate	10.28	10.19	9.96	10.61	8.39	8.17	6.74	6.07
DPT immunisation rate (% children <2 yrs.)	97.4	97.1	97.3	97.8	98.1	98.1		
Kindergarten enrolment rate (% 3-6 yrs.)	57	56.3	56.6	55.8	56.2	60.3	62.8	65.1
Basic school enrolment rate (% 7-15 yrs.)	96	96.1	97.1	96.8	97.6	97.8	96.7	97.3

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.3

Welfare Indicators of the Czech Republic

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	2.4	-1.2	-11.5	-3.3	0.6	2.7	5.9	4.1
Annual inflation rate (%)		10.8	56.6	11.1	20.8	10	9.1	8.8
Annual index of real wages (base=100)	100	93.6	68.9	76	78.8	84.9	92.2	100.4
Registered unemployment rate (%)		0.3	2.6	3.1	3	3.3	3	3.1
Demographic Indicators								
Total population (millions)	10.362	10.363	10.309	10.318	10.331	10.336	10.331	10.315
Share of children in total population (%)	26.9	26.6	26.2	25.6	24.9	24.2	23.5	22.7
Crude birth rate (per 1,000 pop.)	12.439	12.686	12.596	11.836	11.759	10.346	9.334	8.799
Crude death rate (per 1,000 pop.)	12.33	12.5	12.06	11.66	11.44	11.36	11.42	10.93
Female life expectancy at birth (years)	75.4	76.01	75.67	76.11	76.35	76.55	76.94	77.27
Male life expectancy at birth (years)	68.11	67.54	68.21	68.52	69.28	69.53	69.96	70.37
Maternal mortality (per 100,000 live births)	9.349	8.425	13.142	9.86	11.568	6.568	2.081	5.528
Net migration (thousands)	1.5	0.6	2.9	11.8	5.5	9.9	10	10.1
Reproductive Behaviour								
Total fertility rate	1.874	1.893	1.861	1.715	1.666	1.438	1.278	1.185
Share of births to unmarried mothers (%)	7.9	8.55	9.82	10.69	12.66	14.55	15.55	16.9
Share of births to teen mothers (%)	13.61	14.1	15.5	16.2	15.77	13.46	11.04	9
Abortion rate (per 100 live births)	98.56	96.55	92.81	89.79	70.6	63.27	64.09	66.3
Family Stability								
Crude marriage rate (per 1,000 pop.)	7.8	8.8	7	7.2	6.4	5.7	5.3	5.2
General divorce rate (per 100 marriages)	38.6	35.2	40.8	38.6	45.8	52.9	56.7	61.4
Children involved in divorce (thousands)	34.7	35.2	32	31.1	32.5	33.1	32.8	34.7
Child Welfare								
Infant mortality rate (per 1,000 live births)	10	10.8	10.4	9.9	8.5	7.9	7.7	6
Under 5 mortality rate	11.756	12.438	12.106	11.618	10.138	10.161	9.532	7.85
DPT immunisation rate (% children <2 yrs.)	99	99	99	99	99	98	96	98
Kindergarten enrolment rate (% 3-6 yrs.)	89.8	89.8	89.8	83.3	84.9	86.6	88.7	88.5
Basic school enrolment rate (% 7-15 yrs.)	96.9	97.3	99.3	98.6	97.4	96.1	95.3	92

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.4

Welfare Indicators of Slovakia

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	1.1	-2.5	-14.6	-6.5	-3.7	4.9	6.8	6.9
Annual inflation rate (%)		10.8	61.2	10.1	23.2	13.4	9.9	5.8
Annual index of real wages (base=100)	100	94.2	67.3	72.6	69.2	71.4	75.3	81.9
Registered unemployment rate (%)		0.6	6.6	11.4	12.7	14.4	13.8	12.6
Demographic Indicators								
Total population (millions)	5.276	5.28	5.284	5.305	5.325	5.346	5.364	5.372
Share of children in total population (%)	30.6	30.4	30.1	29.7	29.2	28.6	27.9	27.2
Crude birth rate (per 1,000 pop.)	15.255	15.226	14.942	14.137	13.818	12.465	11.501	11.236
Crude death rate (per 1,000 pop.)	10.22	10.35	10.34	10.07	9.9	9.61	9.83	9.54
Female life expectancy at birth (years)	75.2	75.4	75.2	76.2	76.7	76.5	76.3	76.65
Male life expectancy at birth (years)	66.8	66.6	66.8	67.6	68.4	68.3	68.4	68.8
Maternal mortality (per 100,000 live births)	9.986	6.251	14	1.34	12.286	6.027	8.14	4.99
Net migration (thousands)		0.1	1.2	2	1.8	4.8	2.8	2.3
Reproductive Behaviour								
Total fertility rate	2.081	2.086	2.05	1.979	1.92	1.66	1.52	1.47
Share of births to unmarried mothers (%)	7.19	7.61	8.95	9.76	10.55	11.71	12.61	14.02
Share of births to teen mothers (%)	11.9	12.05	14	14.34	14.34	13.43	12.3	11.73
Abortion rate (per 100 live births)	70.28	70.23	67.64	66.36	62.18	62.17	58.41	51.37
Family Stability								
Crude marriage rate (per 1,000 pop.)	6.9	7.7	6.2	6.4	5.8	5.3	5.1	5.1
General divorce rate (per 100 marriages)	22.7	21.9	24.1	23.8	26.5	30.8	32.7	34.2
Children involved in divorce (thousands)	10.9	13.5	10.3	9.7	9.7	10.3	6.8	7
Child Welfare								
Infant mortality rate (per 1,000 live births)	13.5	12	13.2	12.6	10.6	11.2	11	10.2
Under 5 mortality rate	15.84	14.06	15.41	14.7	12.7	13.2	13.12	
DPT immunisation rate (% children <2 yrs.)	99.1	99.4	99.7	99.3	99.1	98.9	99.1	
Kindergarten enrolment rate (% 3-6 yrs.)	91.5	83.7	75.7	78.1	78	74.6	70.2	75.2
Basic school enrolment rate (% 7-15 yrs.)	96.8	97.2	98	99.8	99.5	97	96.5	96.3

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.5

Welfare Indicators of Poland

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	0.2	-11.6	-7	2.6	3.8	5.2	7	6
Annual inflation rate (%)		585.8	70.3	43	35.3	32.2	27.8	19.9
Annual index of real wages (base=100)	100	75.6	75.4	73.3	71.2	71.6	73.7	77.9
Registered unemployment rate (%)		6.1	11.8	13.6	16.4	16	14.9	13.6
Demographic Indicators								
Total population (millions)	37.962	38.111	38.246	38.364	38.461	38.543	38.595	38.624
Share of children in total population (%)	29.9	29.7	29.5	29.3	28.9	28.4	27.9	27.3
Crude birth rate (per 1,000 pop.)	14.978	14.475	14.419	13.52	12.94	12.586	11.305	11.164
Crude death rate (per 1,000 pop.)	10.09	10.24	10.61	10.29	10.2	10.03	10	9.98
Female life expectancy at birth (years)	75.45	75.49	75.27	75.7	76	76.1	76.4	76.6
Male life expectancy at birth (years)	66.76	66.51	66.11	66.7	67.4	67.5	67.6	68.1
Maternal mortality (per 100,000 live births)	10.63	12.78	12.78	9.899	11.734	11.012	9.928	4.904
Net migration (thousands)	24.4	15.8	15.9	11.6	15.5	19	18.2	13.1
Reproductive Behaviour								
Total fertility rate	2.046	2.039	2.049	1.929	1.847	1.798	1.611	1.6
Share of births to unmarried mothers (%)	6.14	6.51	6.93	7.48	8.45	8.98	9.47	10.17
Share of births to teen mothers (%)	7.35	8.01	8.47	8.43	8.34	8.2	8.01	7.83
Abortion rate (per 100 live births)	14.6	10.89	5.66	2.27	0.25	0.18	0.13	
Family Stability								
Crude marriage rate (per 1,000 pop.)	6.7	6.7	6.1	5.7	5.4	5.4	5.4	5.3
General divorce rate (per 100 marriages)	18.5	16.6	14.5	14.7	13.4	15.2	18.4	19.4
Children involved in divorce (thousands)	50.1	45.1	35.8	33.5	28.4	32.8	40.6	42.2
Child Welfare								
Infant mortality rate (per 1,000 live births)	19.1	19.3	18.2	17.3	16.1	15.1	13.6	12.2
Under 5 mortality rate	21.8	21.9	20.4	19.6	18.1	17.3	15.6	14.14
DPT immunisation rate (% children <2 yrs.)		90.1	88.9	88	89	89.5	90.5	91.7
Kindergarten enrolment rate (% 3-6 yrs.)	48.7	47.1	43.9	42.6	42.7	44.3	45.3	46.8
Basic school enrolment rate (% 7-15 yrs.)	97.9	97.5	97.3	97.1	97.2	97.1	97.2	97.4

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.6

Welfare Indicators of Hungary

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	0.4	-3.5	-11.9	-3.1	-0.6	2.9	1.5	1
Annual inflation rate (%)		28.9	35	23	22.5	18.8	28.2	23.6
Annual index of real wages (base=100)	100	94.3	87.7	86.5	83.1	89.1	78.2	74.3
Registered unemployment rate (%)	0.4	0.8	8.5	12.3	12.1	10.4	10.4	10.5
Demographic Indicators								
Total population (millions)	10.481	10.365	10.346	10.324	10.294	10.261	10.229	10.193
Share of children in total population (%)	25.1	25.1	24.9	24.5	23.9	23.3	22.8	22.2
Crude birth rate (per 1,000 pop.)	11.826	12.193	12.351	11.84	11.411	11.305	10.993	10.366
Crude death rate (per 1,000 pop.)	13.8	14.05	14	14.41	14.6	14.31	14.22	14.04
Female life expectancy at birth (years)	73.79	73.71	73.83	73.73	73.81	74.23	74.5	74.7
Male life expectancy at birth (years)	65.44	65.13	65.02	64.55	64.53	64.84	65.3	66.1
Maternal mortality (per 100,000 live births)	15.409	20.688	12.578	9.858	18.798	10.381	15.171	11.399
Net migration (thousands)	21.8	25.7	17.4	10.4	12.9	9.2	11.2	7
Reproductive Behaviour								
Total fertility rate	1.78	1.84	1.86	1.77	1.69	1.64	1.57	1.46
Share of births to unmarried mothers (%)	12.39	13.14	14.15	15.6	17.64	19.44	20.68	22.62
Share of births to teen mothers (%)	12.25	12.27	12.27	12.42	12.6	12.49	11.53	10.96
Abortion rate (per 100 live births)	73.4	71.92	70.7	71.53	64.3	64.44	68.68	72.76
Family Stability								
Crude marriage rate (per 1,000 pop.)	6.4	6.4	5.9	5.5	5.3	5.3	5.2	4.8
General divorce rate (per 100 marriages)	37.3	37.5	39.9	37.9	41.3	43.3	46.5	46.2
Children involved in divorce (thousands)	26.1	26.1	25.4	22.9	22.9	23.3	24.9	21
Child Welfare								
Infant mortality rate (per 1,000 live births)	15.7	14.8	15.6	14.1	12.5	11.5	10.7	10.9
Under 5 mortality rate	18	16.78	17.59	15.95	14.6	13.5	12.5	12.7
DPT immunisation rate (% children <2 yrs.)	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.8
Kindergarten enrolment rate (% 3-6 yrs.)	85.7	84.9	85.9	86.5	86.6	86.1	86.9	87
Basic school enrolment rate (% 7-15 yrs.)	99	99.2	99.2	99.2	99.1	99.1	99.1	99.2

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.7

Welfare Indicators of Romania

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	-5.8	-5.6	-12.9	-8.7	1.5	3.9	7.1	4.1
Annual inflation rate (%)		5.1	161.1	210.4	256.1	136.7	32.3	38.8
Annual index of real wages (base=100)	100	105.2	88.9	77.3	64.4	64.6	72.7	79.8
Registered unemployment rate (%)			3	8.2	10.4	10.9	9.5	6.3
Demographic Indicators								
Total population (millions)			23.002	22.795	22.763	22.73	22.684	22.619
Share of children in total population (%)	28.7	28.4	28.1	27.7	27	26.3	25.6	24.9
Crude birth rate (per 1,000 pop.)	16.077	13.662	12.051	11.498	11.052	10.926	10.497	10.291
Crude death rate (per 1,000 pop.)	10.68	10.65	10.95	11.58	11.57	11.71	11.98	12.65
Female life expectancy at birth (years)	72.41	72.65	73.05	73.17	73.17	73.32	73.36	73.09
Male life expectancy at birth (years)	66.51	66.56	66.59	66.56	66.06	65.88	65.7	65.3
Maternal mortality (per 100,000 live births)	169.398	83.559	66.479	60.293	53.201	60.388	47.752	41.064
Net migration (thousands)	41.4	96.9	42.6	29.4	17.2	16.3	21.2	19.5
Reproductive Behaviour								
Total fertility rate	2.2	1.84	1.57	1.52	1.44	1.41	1.34	1.3
Share of births to unmarried mothers (%)					17	18.29	19.75	20.71
Share of births to teen mothers (%)	15.14	15.22	16.9	17.36	18.37	17.93	17.25	16.54
Abortion rate (per 100 live births)	52.1	315.26	314.93	265.7	234.31	214.88	212.49	197.2
Family Stability								
Crude marriage rate (per 1,000 pop.)	7.7	8.3	8	7.7	7.1	6.8	6.8	6.6
General divorce rate (per 100 marriages)	20.2	17.1	20.2	16.8	19.3	25.7	22.7	23.7
Children involved in divorce (thousands)	30.6	27.7	30.5	23.6	21.6	32.8	27.2	26.8
Child Welfare								
Infant mortality rate (per 1,000 live births)	26.9	26.9	22.7	23.3	23.3	23.9	21.2	22.3
Under 5 mortality rate	34.9	35.7	30.8	30.5	30.3	29.7	26.2	27.5
DPT immunisation rate (% children <2 yrs.)	79.3	75.5	77.3	86.8	97.6	97.6	98.3	98
Kindergarten enrolment rate (% 3-6 yrs.)	63.3	54.3	51.9	53.3	50.2	55.2	58.4	55.1
Basic school enrolment rate (% 7-15 yrs.)	93.6	89.5	89.4	89.6	90.3	91.4	92.6	93.9

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.8

Welfare Indicators of Bulgaria

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	-0.3	-9.1	-11.7	-7.3	-2.4	1.8	2.1	-10.9
Annual inflation rate (%)		26.3	333.5	82	73	96.3	62	123
Annual index of real wages (base=100)	100	111.5	68	76.7	77.6	63.7	60.2	49.6
Registered unemployment rate (%)				13.2	15.8	14	11.4	11.1
Demographic Indicators								
Total population (millions)			8.718		8.632	8.54	8.472	8.444
Share of children in total population (%)	25.1	24.8	24.5	23.9	23.3	22.8	22.3	21.7
Crude birth rate (per 1,000 pop.)	12.724	12.138	11.181	10.514	10.031	9.467	8.616	8.698
Crude death rate (per 1,000 pop.)	12.04	12.46	12.79	12.65	12.93	13.24	13.64	14
Female life expectancy at birth (years)	75.1	74.8	74.7	74.5	74.6	74.9	74.9	74.6
Male life expectancy at birth (years)	68.6	68.1	68	68	67.7	67.3	67.1	67.1
Maternal mortality (per 100,000 live births)	18.702	20.917	10.426	21.316	14.218	12.588	19.453	
Net migration (thousands)	217.6	87.6	46.5	67.7	64.4	62.7	50.5	66.1
Reproductive Behaviour								
Total fertility rate	1.9	1.81	1.65	1.54	1.45	1.37	1.23	1.24
Share of births to unmarried mothers (%)	15.52	18.45	22.11	24.5	25.73	28.1		
Share of births to teen mothers (%)	23.51	24.64	24.91	23.73	22.62	21.11		
Abortion rate (per 100 live births)	117.57	137.52	144.31	149.09	127.27	122.82	134.91	136.54
Family Stability								
Crude marriage rate (per 1,000 pop.)	7.1	6.9	5.7	5.2	4.7	4.5	4.4	4.3
General divorce rate (per 100 marriages)	20	19	22.6	21.1	18.3	21.1	29	28
Children involved in divorce (thousands)	14.1	12.7	12	10.3	7.8	7	9.3	8.6
Child Welfare								
Infant mortality rate (per 1,000 live births)	14.4	14.8	16.9	15.9	15.5	16.3	14.8	15.6
Under 5 mortality rate	18.3	18.7	21.4	20.6	19.6	20.9	19	19.84
DPT immunisation rate (% children <2 yrs.)	99.5	99.5	99.4	97.9	97.7	93.3	94.8	95.1
Kindergarten enrolment rate (% 3-6 yrs.)	69.1	67.7	58.7	62.5	60.4	62.6	67.5	69.2
Basic school enrolment rate (% 7-15 yrs.)	98.4	98.6	97.3	95.1	94	94.3	93.7	93.6

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.9

Welfare Indicators of Ukraine

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	5	-3.4	-11.6	-13.7	-14.2	-23	-11.8	-10.1
Annual inflation rate (%)		4.2	91	1210	4700	891	376	80
Annual index of real wages (base=100)								
Registered unemployment rate (%)					0.4	0.4	0.5	1.5
Demographic Indicators								
Total population (millions)	51.518	51.637	51.746	51.896	51.925	51.667	51.277	51.001
Share of children in total population (%)	25.9	25.7	25.5	25.4	25.1	24.8	24.5	24.1
Crude birth rate (per 1,000 pop.)	13.532	12.838	12.294	11.593	10.874	10.219	9.678	9.224
Crude death rate (per 1,000 pop.)	11.66	12.19	12.95	13.43	14.28	14.8	15.46	15.23
Female life expectancy at birth (years)	75	75	75	74	73	73.2	72.7	
Male life expectancy at birth (years)	66	66	66	64	63	62.8	61.8	
Maternal mortality (per 100,000 live births)	32.707	32.41	29.803	31.335	32.827	31.253	32.261	30.393
Net migration (thousands)	108.9	139.3	148.4	288.1	49.6	143.2	94.8	131.1
Reproductive Behaviour								
Total fertility rate	1.9	1.9	1.7	1.7	1.6	1.5	1.4	1.3
Share of births to unmarried mothers (%)	10.81	11.18	11.9	12.12	13.01	12.83	13.21	13.6
Share of births to teen mothers (%)	14.13	16.13	17.31	18.33	18.86	19.53	19.86	19.47
Abortion rate (per 100 live births)	153.18	155.06	151.71	156.22	154.45	147.64	145.2	
Family Stability								
Crude marriage rate (per 1,000 pop.)	9.5	9.3	9.5	7.6	8.2	7.7	8.4	6
General divorce rate (per 100 marriages)	39.6	39.9	40.7	56.5	51.2	52	45.9	62.8
Children involved in divorce (thousands)	155.9	158.5	170.7	186.7	184.7			
Child Welfare								
Infant mortality rate (per 1,000 live births)	13	12.8	13.9	14	14.9	14.5	14.4	14.3
Under 5 mortality rate	17.432	17.151	18.378	18.59	19.657	19.36	19.745	19.259
DPT immunisation rate (% children <2 yrs.)	79.2	78.8	86	88.1	95.6	91.5	95.8	
Kindergarten enrolment rate (% 3-6 yrs.)	61	57.4	51	54.7	49.4	47	44.3	41
Basic school enrolment rate (% 7-15 yrs.)	93.1	93.5	92.4		91.6	90.8	91	90.3

Source: TransMONEE database 3.0, UNICEF, 1998.

Table 1.1.10

Welfare Indicators of Khazakstan

	1989	1990	1991	1992	1993	1994	1995	1996
Macroeconomic Context								
GDP growth rate (% change)	-0.1	-0.4	-13	-2.9	-10.4	-17.8	-8.9	1.1
Annual inflation rate (%)			78.8	1381	1662.3	1892	176.3	39.1
Annual index of real wages (base=100)			100	64.8	49.1	32.9	33.4	34.4
Registered unemployment rate (%)				0.5	0.6	0.8	1.7	3.6
Demographic Indicators								
Total population (millions)	16.645	16.67	16.806	16.903	16.892	16.739	16.54	16.471
Share of children in total population (%)	36.9	37	36.7	36.5	36.2	35.9	35.6	35.1
Crude birth rate (per 1,000 pop.)	22.965	21.796	21.069	20.025	18.723	18.311	16.748	15.371
Crude death rate (per 1,000 pop.)	7.6	7.73	8.01	8.15	9.25	9.59	10.21	10.08
Female life expectancy at birth (years)	73.1	73	72.9	72.7	71.9	71	70.4	
Male life expectancy at birth (years)	63.9	67.7	63.3	63	61.8	60.6	59.7	
Maternal mortality (per 100,000 live births)	53.104	54.77	48.009	57.02	49.642	48.286	57.399	52.928
Net migration (thousands)	93.4	130.9	48.9	179.3	222.1	414.4	238.5	175.5
Reproductive Behaviour								
Total fertility rate	2.877	2.719		2.5	2.3		2.26	
Share of births to unmarried mothers (%)	12.01	13.17	13.42	13.36	13.4	14.47	15.69	17.6
Share of births to teen mothers (%)	8.69	10.04	10.93	11.17	12.23	13.04	13.03	12.65
Abortion rate (per 100 live births)								
Family Stability								
Crude marriage rate (per 1,000 pop.)	9.9	9.9	9.9	8.7	8.7	7.4	7	6.2
General divorce rate (per 100 marriages)	27.7	26.5	29.5	33.9	31.1	34	33.5	39.5
Children involved in divorce (thousands)	41.1	40.5	45.8	47.4	43.6	39.2	37.1	39.3
Child Welfare								
Infant mortality rate (per 1,000 live births)	25.9	26.4	27.4	26.1	28.4	27.2	27.3	25.4
Under 5 mortality rate		34.915	35.628	34.183	38.098	36.175	38.425	35.173
DPT immunisation rate (% children <2 yrs.)	84.8	84.2	82.7	85.3	81.6	84.4	92.9	95
Kindergarten enrolment rate (% 3-6 yrs.)	54.7	53.5	52.5	45.3	39.8	29.3	23.5	
Basic school enrolment rate (% 7-15 yrs.)	93.9	93.1	92.7	91.7	91.5	90.9	90.5	90

Source: TransMONEE database 3.0, UNICEF, 1998.

Appendix 1.2

Alternative Measures of Fertility

This appendix presents alternative measures of fertility and discusses the pros and cons in each case.

1. The Crude Birth Rate (CBR)

- The crude birth rate (CBR) is the simplest and commonest measure of natality.
- In general, it is defined as the number of births in a year per 1,000 mid-year population.
- It is the principal characteristic of a 'crude' birth rate that all ages and both sexes are represented in the rate. As a result, the CBR depends on the age-structure of the population. For example, the observed fall in the birth rate in 1960 may simply come from the fact that the number of women in childbearing age (say 20 years old) is unusually low. These women were born around the time of World War II (1940).
- The CBR is readily available from official registration data.

2. The Age-Specific/Adjusted Fertility (Birth) Rate (ASFR)

- The age-specific fertility rate (ASFR) is defined as the number of births to women of a given age group, per 1,000 women in that age group. Generally, the rates are defined for 5-year age-groups: 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49.
- The ASFR is unaffected by differences between the groups in age-sex composition.

3. The Total Fertility Rate (TFR)

- The Total Fertility Rate (TFR) is a *synthetic* index and represents an *approximate* measure for the average size of a family.
- Specifically, it shows the total number of children a woman would have if she were subject to the age-specific fertility rates of women that year.
- It is computed as the sum of the age-specific fertility rates in a given year. Table 1.2.1 shows, for example, the TFR in 1995 in Russia. The TFR is obtained by adding the ASFR and multiplying the result by 5 (given the use of fertility rates by group of five years). Thus, the TFR = (45.6 + 113.5 + 67.2 + 29.7 + 10.7 + 2.2 + 0.1) = 269.3

per 1,000 women (or 0.2693); 0.2693 × 5 = 1.347. In 1995, the TFR is equal to 1.347.

- The TFR does not equate the number of children women will actually have or the number they expect to have by the time they complete childbearing, because the TFR is influenced by the *timing of birth.* As I will show in appendix 1.3, the TFR can be low if women are postponing births to future years, but compensating by having more children in other years, leaving their true family size (or completed fertility) unaffected. As a result, the TFR may exaggerate current trends in relation to the final future outcome of family size, whenever changes in births are due to shift in the timing of birth.

Table 1.2.1

Population, Births, and Age-Specific Fertility Rate, Russia, 1995

	Population	Births	ASFR (0/00)
15-19 years	5,219,715	238,019	45.6
20-24 years	4,949,744	561,796	113.5
25-29 years	4,603,735	309,371	67.2
30-34 years	5,761,448	171,115	29.7
35-39 years	6,375,607	68,219	10.7
40-44 years	5,942,273	13,073	2.2
45-49 years	5,720,000	572	0.1
		Total:	269.3

Source: Goskomstat (1996) and author's own computation.
Note: ASFR (col 3) = Births (col 2)/average population (col.1)

4. Cumulative and Completed Fertility

- As noted above, the TFR is by no mean an exact measure of the average size of a family. For that, it is necessary to know the exact history of a particular birth cohort and derive the completed fertility rate.
- A cohort (or generation) is a group of people with a common characteristic referenced to a fixed point in time. For example, all women born in 1930 or all women married for the first time in 1970 when aged 20-24 are cohorts. The cohort method of analysis is concerned with examining how different cohorts compare one with another in respect to some variables of particular interest.

- The concepts of cumulative and completed fertility are better illustrated with an example. Consider an array of age-specific fertility rates, for a current year and a series of earlier years, for each age 15 to 49 identified in terms of year of birth. Table 1.2.2 shows a portion of such an array, i.e. age-specific rates for ages 15 to 19 from 1941 to 1945. I can attribute to a particular cohort the rates that concern her from the reading of the appropriate diagonal. For example, I can detect what concerns the cohort reaching age 15 in 1941, thus born in 1941 – 15 = 1926.
- Table 1.2.3 derives the set of cumulative fertility rates showing fertility up to each successive age. This table shows the fertility progress of the 1926-birth cohort through the childbearing ages. For example, at the age of 19, the cumulative fertility rate achieved by the 1926 cohort, is of 420 births per 10,000 women (10 + 42 + 112 + 256).
- The completed fertility rate at the age of 50 for this the 1926-birth cohort is of 25,661 births per 10,000 women, the equivalent of 2.57 births per women.

Table 1.2.2

Total Fertility, by age *(per 10,000 women)*

Age	1941	1942	1943	1944	1945
15 years	**10**	11	11	11	10
16 years	37	**42**	27	36	58
17 years	98	108	**112**	114	124
18 years	211	236	267	**256**	279
19 years	370	420	512	497	**511**
...	...	...	...	...	...
48 years	5	6	4	4	4
49 years	5	6	5	4	3
Total	18,208	20,110	21,879	22,422	23,025

Source: Pressat, 1981.

Table 1.2.3

Cumulative and Completed Fertility Rates for the 1926 birth-cohort

Age	Total Fertility *(by age)*	Cumulative Fertility
15 years	**10**	0
16 years	**42**	10
17 years	**112**	52
18 years	**256**	164
19 years	**511**	420
...	...	...
48 years	3	25,656
49 years	2	25,659
50 years	-	25,661

Note: the final figure of the series gives the completed fertility
Source: Pressat, 1981.

Appendix 1.3

On the Volatility of the Total Fertility Rate

Coleman and Salt (1992) states that the Total Fertility Rate (TFR) exaggerates current trends in relation to the final outcome of family size whenever changes in births are due to a shift in the timing of birth. This appendix presents a small model to examine how this may happen.

I construct a model where individuals live for 5 periods. They can have children in the first four years of their lives. I assume the following age-specific fertility rates (ASFR per 100 women):

- at age 1 of their lives, the $ASFR_1 = 10$;
- at age 2 of their lives, $ASFR_2 = 80$;
- at age 3 of their lives, $ASFR_3 = 60$;
- at age 4 of their lives, $ASFR_4 = 40$.

I assume that individuals live until the end of age 5. In this simple world, *the Total Fertility Rate* (TFR) is equal to 1.9[14].

Let me now examine two scenarios.

Table 1.3.1

Total Fertility by age - Scenario 1

Child-bearing Age	Year 1	Year 2	Year 3	Year 4
Age 1	**10**	10	10	10
Age 2	80	**80**	80	80
Age 3	60	60	**60**	60
Age 4	40	40	40	**40**
TFR:	1.9	1.9	1.9	1.9

Note: Completed Fertility for cohort 1 is in bold--see below.

In the first scenario, I assume that the above age-specific rates are observed every year. As shown in table 1.3.1, all women at age 1 of their lives experience an age-specific fertility rate of 10. This $ASFR_1$ prevails in year 1, year 2, year 3 and year 4. Similarly, all women at age 2 of their lives experience

[14] The TFR is derived as the sum of the age-specific fertility rates. Thus, $TFR = ASFR_1 + ASFR_2 + ASFR_3 + ASFR_4 = 10 + 80 + 60 + 40 = 190$ (or 1.9 per 100 women).

an age-specific fertility rate of 80. This $ASFR_2$ prevails in year 1, year 2, year 3 and year 4. To sum up, in this static world, the pattern of ASFR (10/80/60/40) is reproduced every year.

In the second scenario, some women decide, for whatever reason, to postpone their decision to have a child from year 2 to year 3. I now show that the effect of this shift in the timing of birth is a fall in the TFR in year 2, leaving the completed fertility *unchanged.*

Table 1.3.2

Total Fertility by age - Scenario 2

Child-bearing Age	Year 1	Year 2	Year 3	Year 4
Age 1	**10**	5	10	10
Age 2	80	**40**	80 + 5	80
Age 3	60	30	**60 + 40**	60
Age 4	40	20	40 + 30	**40**
TFR:	1.9	0.9	2.7	1.9

For simplicity, I assume that all the ASFR in year 2 are halved. This means that half of all the women (in childbearing age) decide to delay births. Thus, table 1.3.2 shows that the ASFR in year 2 are equal to 5, 40, 30 and 20. In year 3, women decide to make up for lost time. Thus, in year 3, these women have the 'normal' ASFR plus the 'delayed births'.

The computation is best illustrated by an example. Let me consider women of cohort 1. These women are in childbearing age 3 in year 3. These women have the 'normal' ASFR of 60. On top of that, they have to make up for lost time in the earlier year. In year 2, these women were in childbearing age 2 and were thus expected to have a fertility rate of 80 ($ASFR_2 = 80$). At the time, they only had 40 children. The other 40 were postponed to the following year. At the end of year 3, women of cohort 1 have a fertility rate of 100 (60 + 40). The same computation is carried for each cohort in year 3.

In scenario 2, the TFR fluctuates quite a lot in year 2 and 3--the TFR at the end of year 3 is equal to 2.75, and is back to 1.9 at the end of year 4. The fluctuation in the TFR is due to a simple shift in the timing of births. I will now show that, in both scenarios, the completed fertility rate is unchanged.

I derive the completed fertility rate by birth cohorts. As discussed in appendix 1.2, the completed fertility rate is calculated from the diagonal of the Total Fertility Table. Let me give an example for the birth cohort 1. As shown in table 1.3.3, for women born in year 1 the completed fertility is equal to 1.9. Thus, in the first scenario, the total fertility rate is equal to the completed fertility rate for every year.

Table 1.3.3

Completed Fertility for Birth Cohort 1 - Scenario 1

	ASFR	Cumulative Fertility
Age 1	**10**	0
Age 2	**80**	10
Age 3	**60**	90
Age 4	**40**	150
Age 5	-	190
Completed Fertility		1.9

Source: Author's own computation

In scenario 2, it can be shown that the actual family size is unaffected over time: the completed fertility for birth cohorts 1, 2, 3 and 4 is 1.9.

Table 1.3.4

Completed Fertility for Birth Cohort 1 - Scenario 2

	ASFR	Cumulative Fertility
Age 1	**10**	0
Age 2	**40**	10
Age 3	**100**	50
Age 4	**40**	150
Age 5	-	190
Completed Fertility		1.9

Source: Author's own computation

II. The Determinants of Changes in Reproductive Behaviour:

An Analytical Survey of Economic, Sociological and Demographic Theories

"One of the greatest pieces of economic wisdom is to know what you do not know"
John K. Galbraith

Introduction

This chapter presents an analytical survey of half of a century of investigation into reproductive behaviour. Despite intensive research, there is no single grand explanation on why and how reproduction changes over time. There are fundamentally three approaches to the topic, i.e. economic, sociological and demographic, with each of them talking at cross-purposes. In an effort to find out the reasons for this disagreement, this chapter contrasts the different approaches and establishes the limitations and strengths in each case. This comparative analysis helps to a better understanding of the most important theories in the field of reproductive choice.

There is at least one consensus in the field, i.e. the fact that there is no single theory on the causes for fertility change over time. "We have to accept the fact that there is no general theory of fertility determinants, even tentative ones, which might explain fertility movements and differentials as a whole. Most of the quantitative analyses help to explain, at best, 10 to 20 percent of fertility variance" (Leridon 1981).

The field of reproductive choice emerges as a collection of quite distinct, often contradictory approaches to the question of fertility change. For example, I will show that economic theory considers reproductive decisions as a matter of conscious and individual choice. In contrast, in the 'classical' demographic paradigm, apparent elements of conscious and individual choice are constrained by superior laws of Nature and a Darwinian process of natural selection.

The gap between disciplines became so wide that it makes any attempt to relate them extremely difficult. Its results are open disagreements and disciplines talking at cross-purposes. Economists, for example, reached the conclusion that "Demography is too important to be left to demographers" (Kirk 1996). In contrast, demographers consider that economists' efforts to develop a theory of fertility is "like the invasion of a horde of primitives on a technologically advanced community proclaiming loudly their intent to reinvent the wheel" (Leibenstein 1974).

Each discipline fails to provide a solid and testable theory on the causes for fertility change. Robinson (1997) argues that, "conclusions and new policy-relevant implications (in the economic theory of reproduction) have proven curiously elusive". Moreover, "a number of attempts have been made to 'test' empirically the capacity of the (economic) theory to explain fertility differentials... The basic answer that emerges is that for the most part the facts do not appear to be in conformity with theory" (Leibenstein 1974).

The sociological framework became so general and its theoretical relationships so flexible that it could not generate unambiguous testable hypotheses regarding the specific causes of fertility change. Finally, the demographic theory "seems like a grand historical generalization buttressed by a variety of *ad hoc* causal assertions" (Leibenstein 1974). Szreter (1993) stresses its "ability to survive a continuous stream of contradictory findings that would long ago have killed off more mortal entities". He continues:

> "It is a remarkable paradox that although there has been an accumulation of modern and early modern historical evidence that would seem to have comprehensively discredited the accuracy and the validity of demographic transition as either a theory or a general historical description, this model of demographic change remains a central preoccupation in contemporary population studies."

The objective of this chapter is to go into the fundamental debate on reproductive choice to find out why these disciplines talk at cross-purposes. The scheme of the chapter is as follows: section 1 examines the economic model of reproductive behaviour. Section 2 studies the sociological model, and section 3 focuses on what I shall refer to as the 'classical' demographic model of fertility. The paper contains the state of discussion as it presents itself at the present time. Because of the excellent survey that has been made by Van de Kaa (1996), I confine myself to review tendencies in research, with no pretence of balanced or comprehensive coverage.

1. The Economic Model of Reproductive Behaviour

This section examines the economic model of reproductive behaviour. The discussion focuses on the economic theory of Gary Becker. Broadly speaking. Becker's theory is a straightforward application of the Rational Choice theory in general, and consumer choice theory in particular, to reproductive choice. I first expose, and then apply, Rational Choice theory to reproductive decisions. Finally, I discuss two extensions of this simple model: the first deals with the inter-temporal dimension, and the second with the collection dimension of reproductive decisions.

1.1. Behavioural Foundations of Economic Theory

Economic theory rests upon a specific conception of human behaviour. It is based on the belief that human action involves a 'choice' among a range of alternatives, and there is a correspondence between the actual choice and the use of reason. These are the foundations of Rational Choice theory and constitute the prevailing economic paradigm. In this part I examine the behavioural foundations of Rational Choice theory (under certainty)[15]. The description is organized along three questions: what is the object of choice? What structures this choice? What principle leads to this choice? These questions will be used further below to highlight the essential differences between the prevailing economic paradigm on the one hand, and the prevailing sociological and demographic paradigms on the other hand.

1.1.1. Context of Choice

Economic theory focuses on individual choice. It assumes that each individual has to make a choice between commodity bundles. The objects of choice can be unambiguously and objectively described.

In practice, "each decision is effectively a choice among total life histories. Such a theory is certainly impractical, and we are thus forced to compartmentalize the different aspects of life, decisions in each area being treated in some sense independently" (Arrow 1984). Thus, economic theory provides a partial equilibrium analysis of the total life histories. This is even true in what is known as General Equilibrium analysis.

[15] Chapter V reexamines the behavioural assumptions of economic theory under uncertainty.

1.1.2. Structure of Choice

The axiomatic requirements of Rational Choice theory are as follows:

1. Preference ordering. Each individual is assumed to be able to rank all alternative commodity bundles in order of preference[16].

2. Internal Consistency. The ordering of all conceivable alternatives represent the 'revealed preferences' (or tastes) of an individual. For example, if an individual is observed to choose x rejecting y, he is declared to have revealed a preference for x over y. 'Revealed preferences' can be represented by an ordinal binary relation. A choice is said to be inconsistent if the individual chooses x and rejects y on one occasion and then promptly proceeds to do the exact opposite.

3. Other Requirements. In more demanding formulations of the theory, additional requirements can include 1) the binary relation is transitive, and /or 2) the binary relation is represented by a cardinal function—more commonly known as the Utility function[17]. In the example above, the preference of x over y can be represented by a higher Utility assigned to the preferred alternative.

An individual is described as 'rational' (in the narrow sense) if he does not reveal any inconsistencies in his choice behaviour. In other words, his choices can all be explained in terms of some preference relation consistent with the revealed preference definition (Sen 1982)[18].

[16] His preference ordering is supposed to reflect his interest, represent his welfare, summarize the individual's idea of what should be done, and describe his actual choices and behaviour (Sen 1982).

[17] In general, economic theory assumes diminishing marginal utility. Applied to reproductive decisions, this means that the utility a household gains from a first child is larger than the utility he gains from a second child.

[18] There is a second concept of rationality prevalent in economics. This concept establishes an external correspondence between the choices that a person makes and the *self-interest of the person* (Sen 1998). Rationality is identified with the possibility of justifying each human action in terms of self-interest. For example, when x is chosen by a given individual and y is rejected, this implies that the individual's personal interests are expected by the individual to be better served by x than by y.

North (1990) defines the scope of the rationality assumption:

> "The behavioural assumptions that economists use do not imply that everybody's behaviour is consistent with rational choice. But they do rest fundamentally on the assumption that competitive forces will see that those who behave in a rational manner will survive, and those who do not will fail." [19]

Moreover, individuals are constrained in their choice among alternative actions by what Pareto called the 'obstacles'. Typically, individuals will be constrained by the prices at which they can buy goods (on which they have no influence in a competitive environment) and their income. Together prices of goods and income define each individual's budget constraint.

1.1.3. Principle of Decision-making: Individual Maximization

In its strict form, economic theory considers that individual behaviour, at any moment in time, can be best described as the achievement of the optimal position. The choice among alternative outcomes results from individualistic utility (wealth) maximization under budget constraint.

[19] What happens when there is *no competition* and sanction of the market as in a reproductive choice? Becker ignores those considerations. I am grateful to Judith Shapiro for this point.

1.2. The Economic Theory of Reproductive Behaviour[20]

For the most part, the economic model of reproduction applies the standard behavioural assumptions of Rational Choice theory to reproductive choice. This model is a special version of the consumer choice theory, whereby individuals (or households) are assumed to solve their problems, say, in terms of choosing a family size, by choosing a bundle of children and goods, given the budget constraint, which maximizes utility. This section draws on the seminal contribution of Becker to derive the determinants of fertility change and a simple formalization.

1.2.1. Change in the Price of Children

In economic theory, all goods have a price and for Becker, children are no exception. The 'bundle of children' has a price (or cost) and any variations in this price relative to other commodities influence the quantity demanded of children[21]. I now examine the factors that affect the price of children.

1.2.1.1. The Quality of Children

The first factor that affects the price of children is what Becker (1981) refers to as the "quality of children". The idea is that households decide not only about the number of children (aspect of quantity), but also about their educational goals and their placement. In this framework, increased spending on an individual child begins to compete with a higher number of children with less cost involved. Thus, the desire for children of 'higher quality' may reduce the quantity demanded of children.

To illustrate this trade-off, I draw upon Becker's explanation of fertility behaviour in the black American community (1981). "Blacks have invested less in training because rates of return on investments in education, health, and other training have been lower than for whites. The quantity-quality interaction implies that blacks would respond to poorer investment opportunities with higher fertility. As opportunities

[20] This model is sometimes referred to as Chicago school model. A rival framework is the Pennsylvania school model that gives more emphasis to preference formation and supply factors (see Easterlin, Pollak and Wachter, 1980).

[21] The theory does not distinguish between the acquisition of a baby and purchase of a motor car. Children are treated as 'consumption goods' (on children as investment goods, see for example, Cigno (1992) and Barro and Becker (1986)). This gave rise to Blake (1968)'s acerbic comment in an article entitled "Are babies consumer durables?".

for blacks have improved in recent years, they have invested more in their training and at the same time reduced their fertility relative to whites".

1.2.2.2. The Opportunity Cost of Time

The second factor that affects the cost of children is the opportunity cost of time. To understand this factor, I return to the theory of non-market allocative decision developed by Becker (1965). The idea is that households decide on the allocation of their time. As a scarce resource, time has to be allocated between activities valued at the traditional money price and those that are not valued on the market but carry an opportunity cost. The production and rearing of children for instance are affected by both the traditional money price and the opportunity cost of time.

Mincer (1963) investigated empirically the notion of opportunity cost of time as a determinant of household behaviour. He finds that an increase in the cost of the wife's time tends to reduce fertility. In particular, household will substitute away from children and search for alternative ways of producing children that require less of their time, whenever the relative prices of capital over labour, and the relative wages of men over women fall (Schultz 1974).

1.2.2. Change in Income

The effect of income on the fertility rate presented economists with a puzzle, which in turn stimulated a good deal of research[22]. The central puzzle can be summarized as follows:

- If the price is constant, then higher income groups can afford more children and should want more children. There is no reason to believe that children are 'inferior goods'.
- *De facto*, higher income groups 'buy' fewer children than lower income groups. The analysis of population change shows a long-term negative correlation between the fertility rate and national income per capita (Dasgupta 1992).

To solve this puzzle, Becker investigated the reproductive behaviour of different income groups in the American society. He found that richer families tended to have

[22] Chapter IV discusses and tests empirically the relationship between the fertility rate and income.

fewer children than those with lower incomes. Becker explained his observation as follows:

1. Children are not 'inferior' goods. In fact, as income rises people want more children (the positive income effect).
2. Whenever income rises, the price of children is not held constant: increased parental income (especially maternal income) raises simultaneously the cost of children. For example, parent may want higher quality children. Thus, children become more expensive relative to other goods (the negative substitution effect).
3. The negative price effect is strong enough to outweigh the positive income effect.

Leibenstein (1975) proposes an alternative theory to account for the inverse relation between family size and income level that does not employ or lean heavily on these hypotheses. The central idea is that e*conomic* changes affect the *social* status of families; and that whenever individuals change their social status, their tastes change as well. Tastes change not only for children but simultaneously for a) goods that compete with children; and b) the goods and services involved in the nurture of children. This change in taste is such that it shifts towards a higher preference for goods as against children, as we go up hierarchically recognized social groupings. In other words, the status effect of increased income raises the desire for material goods and lowers the desire for children.

1.2.3. Change in Other Constraints

The economic model of reproduction assumes that individuals voluntarily control their fertility decisions, and that they are only constrained by budgetary factors. In reality, the extent to which individuals control these decisions is limited by other constraints as well[23]. I choose to examine two types of constraints: technology and a general equilibrium effect:

[23] In this paper, I leave aside factors that influence the *supply* of children (except women's age at first marriage in Section 2.2). For a comprehensive study on the supply factors, see Boongaarts and Menken (1983).

1. The availability and cost of contraceptive techniques. Easterlin (1975) developed a model to show that the Western decline in actual childbearing is explained by the increased availability of contraception, the widespread adoption of birth control practices and the lower cost in fertility regulation. Coleman and Salt (1992) strongly criticize this explanation: "this view assumes that people always want fewer babies than they actually have (because of inefficient family planning). Hence any improvement in efficiency or availability of contraception will always drive down the birth rate. Such a simple view cannot accommodate increases in fertility at times when contraceptive knowledge and technique were generally increasing, as in the late 1930s and the post-war baby boom". Why and how this happened are unresolved questions.

2. The provision of housing. The process of household formation depends on societal changes and in particular on the provision of housing. In countries where housing supply varies from place to place and over time, household formation is expected to vary largely (Shapiro 1998).

1.2.4. Economic Theory of Reproductive Choice: Formalization

I now formalize the economic decision of reproduction. The model embodies the standard behavioural assumptions of rational choice theory. It includes some of the determinants of fertility change that I described above (changes in the price of children and individual income) but ignores the other constraints. The model treats each household as a unit of analysis[24] and children as consumption goods. The process of reproductive decision can be decomposed as follows:

1. Structure of Choice

The household chooses between bundles of commodities, one of which being the quantity of children, n. The household views children the same way as the purchase of a durable good. The various other commodities are aggregated into a single commodity, Z.

[24] Dasgupta (1992) relaxes this assumption and allows for members of the household to have different motivations or ordering over allocations.

2. Context of Choice

The household orders the alternative bundles according to its preferences. His tastes are reflected in the Utility Function. The utility function is then:

$$U = U(n, Z) \qquad (1)$$

His choice among alternative bundles is constrained by a budget equation: income Y is spent on the purchase of good Z at price π_z and on children at a cost p_n. Each family is constrained by a budget equation:

$$p_n . n + \pi_z . Z = Y \qquad (2)$$

The household is assumed to be rational:

> "For an economic theory to be valid, one need not to assume that *typical* behavior is 'rational'. It is sufficient that behavior at critical junctures be of a 'rational' type... In addition, it is not required that all households behave this way. If a reasonable proportion do, then an economic theory that depends on rationality is significant" (Leibenstein 1975).

3. Decision-Making Principle

The household consciously optimizes its utility function (1) under prices and income constraint (2). Given p_n, π_z and Y, the optimal quantities of n and Z are determined by the usual marginal condition:

$$MU_n / MU_Z = p_n / \pi_z \qquad (3)$$

4. Demand Functions

From the equilibrium condition (3), the demand equations for commodity Z and n can be derived as a function of prices and income.

$$n = D_n (p_n, \pi_z, Y)$$
$$Z = D_Z (p_n, \pi_z, Y) \qquad (4)$$

The Slutzky equation decomposes the demand change induced by a price change. In particular, it decomposes the change in the demand for children D_n into two effects:

1. Substitution (or relative price) effect. It indicates how the Hicksian demand changes while keeping utility constant. The effect of a rise in the price of commodity Z, π_z, on the quantity demanded of children depends on the degree of substitutability between Z and n. If Z is a perfect complement to n, the rise of π_z will increase the demand for children—a positive substitution effect. If Z is a perfect substitute for n, the rise of π_z will increase the demand for children—a negative substitution effect. Becker assumes that commodity Z is a substitute (although imperfect) for children so that the substitution effect is always negative.

2. Income effect. It indicates the impact of a change in the 'purchasing power' of income on demand, while holding relative prices constant. For normal goods, the income effect is expected to be positive. Becker assumes that children are normal goods. In effect, a fall in the real purchasing power of income (due to a rise in the price of children) will normally reduce the quantity demanded for children.

To sum up, Becker assumes that the preferences are given (or the utility function is fixed[25]). Fertility changes in response to variations in relative prices and income.

[25] Even if the 'income effect' implies a move from one indifference curve to another, preferences remain the same. In technical terms, the utility function is defined up to a monotonic transformation.

1.3. Inter-temporal Theories of Reproductive Behaviour

Becker's theory of reproduction behaviour is static. I now examine alternative models with inter-temporal dimensions.

The first attempt to introduce an inter-temporal dimension to the decision to have children is from the American economist and demographer, Richard Easterlin in the "fertility cycle hypothesis". Easterlin suggested (1968) that population and economy are linked in a perpetual series of fluctuations, powered by income expectations, alternation of cohort size[26], and autonomous cycles in the economy itself (business cycle). His model consists of a set of hypotheses. First, economic aspirations of cohorts of adults are fixed in adolescence through their experience of the household in which they were brought up. Second, fertility of these cohorts depends on the extent to which they can match these aspirations in their subsequent adult life, any shortfall in "relative income" being met with responses to limit fertility. Third, economic opportunities available to large and small cohorts of births are quite different.

For example, members of large cohorts experience fiercer competition throughout their lives for places in schools, university, employment, and promotion. Wage growth will be low and unemployment will be high. Their incomes relative to those of their parents will seem unsatisfactory. To preserve expected standards as far as possible, family size will be kept small. But their children, born into small cohorts, will themselves experience comparatively favourable opportunities for promotion, recruitment and wage increase. Their income relative to their parents will be correspondingly higher, their fertility will be high, and so the cycle will continue (Coleman and Salt 1992).

The second attempt to build a more elaborate model of human behaviour is due to Barro and Becker (1988). They explore altruism as another facet of utility maximization, in which individuals get utility from the well-being of others. The welfare of all generations of a family depends on the consumption, fertility and number of descendants in all generations. Children are viewed as 'investment goods'. The head of a family acts as if he maximizes an inter-temporal utility function[27] subject to an inter-temporal budget

[26] A cohort is a group of people with a common characteristic referenced to a fixed point in time. For example, all women born in 1930 or all women married for the first time in 1970 when aged 20-24 are cohorts.

[27] The inter-temporal utility function arises from parental altruism toward children, where the utility of parents depends on their own consumption, their fertility, and the utility of each child.

constraint that depends on the wealth inherited by the head, the cost of rearing children and earnings in all generations. Utility maximization implies an arbitrage condition for consumption over generations[28].

The Barro-Becker model suffers from one shortcoming: it predicts outcomes under well-informed agents and certainty[29]. For decisions which have implications for the future, like having children, one has to consider that informational problems and uncertainty can become important variables in the decision process. What is, in particular, the effect of uncertainty? For Barr (1998), whenever individuals are risk-averse, uncertainty *per se* entails a welfare loss. Because of uncertainty, individuals tend to demand less of the good than what is optimal (under certainty). I have not found anywhere in the economic literature a discussion of reproductive behaviour under uncertainty.

[28] If the cost of rearing descendants is constant over time, fertility depends on interest rates (positively), the time-preference factor (positively), and the degree of altruism (positively).
[29] This is a simplified interpretation of the Barro-Becker model. In fact, the model assumes that households have a forward-looking (Rational Expectations) behaviour. Chapter V will show that this assumption is unsatisfactory in a context of broad uncertainty.

1.4. Collective Choice and Reproductive Behaviour

The model of reproductive behaviour discussed at this point considers the action of isolated individuals. One question that arises is whether *individual* reproductive decisions are *socially* optimal or yield Pareto-efficient outcomes. Kingsley Davis (1967) replies in the negative. "There is no reason to expect that the millions of decisions about family size made by couples in their own interest will automatically control population for the benefit of society". There may be circumstances in which the desired fertility of individual couples is socially non-optimal, or there is a difference between the social and individual valuation of the costs and benefits of a birth.

There are two broad reasons for a possible dissonance between household and societal levels of reproduction: the ubiquitous phenomenon of externalities, and 'wrong' relative prices of goods and services. I briefly review each explanation.

1. The *1984 World Development Report* states that "one reason (individual and social gains) differ is the existence of externalities" (World Bank 1984). Externalities are the costs and benefits of children that are passed on by parents to society[30]. They include, for instance, the public costs of education, health, and pensions, cost sharing for public goods and social infrastructure. There are many sources of externalities, but their sign is generally uncertain (Lee and Miller 1991).

2. For the sake of completeness, the other source of discrepancy is 'wrong' relative prices of goods and services because of market imperfections. Children are assumed to have a 'market price'. Yet, this price can be incorrect if the market for children is not perfectly competitive (Lee and Miller 1991).

[30] Nerlove, Razin and Sadka (1987) formally discuss the problem of externalities. Their line of argument goes as follows: each couple chooses some level of fertility that maximizes its satisfaction, given its preferences and constraints. The key question is whether the couples could do better if they reach a collective decision about fertility rather than choosing their fertility individually. Put differently, could a social planner with coercive powers over fertility, and acting solely in the interests of the couples as a group, increase their satisfaction over the level they could attain choosing their fertility individually under a policy of laissez-faire in reproduction? If so, then there is a difference between the implicit net cost of a child as perceived by the parents and as recognized on their behalf by the planner. The difference between these perceived costs equals the external costs of a child.

2. The Sociological Model of Reproductive Behaviour

The present section compares the prevailing sociological paradigm with the economic paradigm. It then examines some sociological theories of reproductive choice.

2.1. Sociological and Economic Paradigms: A Comparison

Economists considerably value the contribution of sociology in the field of reproductive choice: sociologists may adopt different methods from those which economists are used to, but most of their concepts, such as 'choice' in human action and 'rationality', are very similar. For example, sociologists admit that human conduct can be directed at the achievement of an aim—in a sense, the "purpose-rational individual behaviour" of Weber is close to the utility-maximizer individual behaviour of economists. Sociologists recognize, however, that human action is not only purpose-rational. Typically, in Max Weber's terms, human action will also be "traditional, affective, and value-rational"(Weber 1922).

This section presents a systematic comparison of the prevailing sociological and economic paradigms. In some respects, it can be argued that there is no essential contradiction between paradigms, but only a difference in emphasis[31]. The comparison articulates around three central questions, previously used to describe the economic paradigm: what is the object of choice? What structures this choice? What principle leads to this choice?

2.1.1. The Context of Choice

The sociological paradigm focuses on the 'social' as opposed to the 'individual' dimension of reproductive behaviour. In this framework, society determines the desirable number of children, or the 'ideal family size'[32].

Opinion surveys help to determine what most people regard as 'ideal'. A typical question of an opinion survey is: "*What do you think* is the ideal family size?". In Britain,

[31] It can be argued that economics studies 'choice' while sociology explains why there is no choice. I am grateful to Norbert Wunner for this point.

[32] The central assumption of the sociological paradigm is as follows: when many members of a society face a recurrent common problem with important social consequences they tend to develop a normative solution to it. This solution, a set of rules of behaviour in a particular situation, becomes part of the culture, and the society indoctrinates its members to conform more or less closely to the norms by implicit rewards and punishments.

for instance, two or three children remain the ideal of 80 percent; only six percent think one or none is ideal (Coleman and Salt 1992). Successive opinion surveys help to determine how preferences change over time. In Britain, most people regard a family size of two children as ideal but this preference seems to have grown stronger over the years (Coleman and Salt 1992).

Sociologists also developed a more realistic measure of family size: the 'expected family size'. This concept embodies a family's target as a result of realistic thinking, in view of a set of economic and political conditions. In Britain, for instance, women born before World War II expected high family size--2.5 children, while women born after the War expected only 2.27 children (Coleman and Salt 1992).

Technically, there is no reason to believe that expectations are not matched by performances. Thus, the sociological concept of 'expected family size' is close to the economists' concept of 'actual family size'. Both family size numbers would be identical in a 'perfect contraceptive population': the widespread and systematic use of contraception would ensure that the desired family size is actually realized in achieved family size, and that there is not any unwanted pregnancies. In reality, Western European populations are not close to efficient contraception.

In contrast, the Russian population is quite close to a perfect contraceptive population. The equality between desired and achieved family size does, however, not result from the widespread use of contraception which remains relatively rare, but from the massive use of abortions. The figures in 1992 show that each woman had on average 2.6 abortions in her childbearing life. This is one of the highest abortion rates in the world (INED 1996).

2.1.2. The Structure of Choice

Sociologists are interested in a different set of questions than economists. Contrary to economists' beliefs, sociologists probably tackle the hardest questions. Sociologists are primarily interested in finding out how tastes (or preferences) are formed. The central object of their investigation is therefore the process of formation of attitudes (or tastes). In contrast, economists assume that tastes are fixed.

I now illustrate both approaches in the context of racial discrimination analysis. A sociologist will be primarily interested in finding out why there is a preference for

discrimination and how 'tastes' towards racial discrimination are formed. In contrast, an economist will assume that tastes for racial discrimination are fixed. Individuals act as if they had "tastes for discrimination" (Becker 1971). In his Nobel Prize lecture, Becker (1996) concludes on the costs of indulging those tastes. "When the majority is very large compared to the minority—in the United States whites are nine times as numerous as blacks and have much more human and physical capital per capita than blacks—market discrimination by the majority hardly lowers its incomes...Discrimination is (therefore) effective. However, when minority members are a sizable fraction of the total, discrimination by members of the majority injures them as well... Its sizable cost to whites helps explain why apartheid...(was) never fully effective and eventually broke down".

In the sociological paradigm, tastes are shaped through 'norms and values'. Each individual has to make a choice (consciously or unconsciously) under the influence of norms that he would have internalized during the process of socialization. These norms shape the 'ideal' behaviour.

If the analysis of the sociological paradigm has been hitherto straightforward, the remaining part becomes quite opaque. I now attempt to explain some of the problems encountered in the sociological paradigm.

The first problem concerns the direction of causality. In some sociological studies, 'norms' are the object of study and the ('ideal') fertility behaviour is taken as given. In other studies, fertility behaviour is the object of study and 'norms and values' are taken as given. These studies led to multi-directional causal relationships. As a result, theories that underlie those relationships cannot generate unambiguous testable hypotheses regarding the specific causes of fertility change.

The second problem concerns the explanatory variables. In the sociological paradigm, 'norms and values' are only 'intermediate' explanatory variables; there are 'ultimate' explanatory variables as well. This distinction forms the weakest part of the paradigm.

As an illustration, let me look at theories that lie at the border of economics and sociology. These theories argue that 'norms and values' are ultimately shaped by the underlying economic and social conditions. For instance, the expectations of economic prosperity and social advancement are expected to contribute to the development of larger

family size ideals and positive opinions on a larger number of children. Thus, social and economic conditions shape the 'norms and values', that in turn define the 'ideal family size'. This implies that fertility changes are determined by changes in social and economic conditions.

Social and Economic Conditions → Norms and Values → Ideal Family Size

This framework leaves at least three fundamental questions open[33]:

1. If 'ideals' are influenced by social and economic conditions, what determines the 'expected family size' – the family's target as a result of a realistic thinking in the face of given conditions? Do socio-economic conditions simultaneously determine 'ideal' and 'expected' family sizes? If this is the case, what is the difference between those concepts?

2. What happens when economic and social conditions change more rapidly than norms and values, as it is often the case? What are the consequences of this 'mismatch'?

3. Why are similar socio-economic conditions producing a different 'norms and values' system?

2.1.3. Decision-making Principle: Satisfaction

The economic paradigm assumes that people make decisions either by going through a maximization calculation or by doing things which result in the maximization of utility, profit or some other maximands (Leibenstein 1981). Economics does not indicate what procedure individuals go through in order to arrive at a decision. Rather, it tells us something about the essential nature of the decision *after* that fact.

In contrast, sociology specifies some the basic characteristics of the decision-making procedures by the decision unit. This may still be a fairly abstract theory: it will not specify all the details of the actual decision making, nor will it capture the full variety of decision procedures actually used by households when they consider whether or not to

[33] For one discussant of the paper, these questions do not invalidate but strengthen the sociological paradigm.

have a child. But it will be concerned with a decision process rather than an approach that argues that whatever is done is the result of maximization.

The dynamics of social behaviour is described as a process that leads either to an optimum or to a weaker form, satisfaction.

2.2. 'Institutional' Theories of Reproductive Behaviour: An Application of the Sociological Paradigm

In this part, I choose to examine theories that attribute a primary role to institutions in the process of formation of 'norms' and 'ideal family size'. I begin with the contribution of Judith Blake, prominent sociologist in the field of family formation. I then briefly conclude with recent avenues of investigation.

In the sociological theory of Blake (1994), "(the) individual is said to be under constraint and suffer coercion, in any society, regarding reproduction". What are those constraints? These constraints correspond to what I referred to above as the 'cost and utility functions' in economics. In the economic theory of reproductive behaviour, fertility is calculated *given* the relative prices/costs of children and *given* the utility of children. In contrast, sociologists will relax the fixity of these functions and investigate their process of formation[34].

'Institutional' theories claim that the individual costs and utility functions are set by the institutional structure of every society—the institutional structure of a society is made up of formal rules (laws and regulations) and informal rules and norms of the broader society (World Bank 1997). "The institutional structure of every society defines and controls what it is that individual couples 'get out' of having children—the rewards or utilities for having a family, and how much couples must sacrifice to have them—the costs" (Blake 1994).

Given these constraints, individuals will adjust their reproductive behaviour. Blake (1994) summarizes the argument: "(Reproductive behaviour) reflects a balancing of the various utilities parents derive from having children and costs they bear in rearing them... People make their 'voluntary' reproductive choices in an institutional context that

[34] For a comprehensive survey on the costs and utilities of children, see Blake (1994)

severely constrains them not to choose non-marriage, not to choose childlessness, not to choose only one child, and even not to limit themselves solely to two children".

Finally, I conclude with two avenues of investigation:

- Change in the Social Institution of Gender. Social forces move the fertility goals of women relative to men in the opposite direction (Dasgupta 1992). In poor societies marked by gender-based asymmetry in employment opportunities and power, women's reproductive goals differ noticeably from those of men. As women are becoming increasingly (economically) independent from male family members, their desires for children, as well as their age of marriage, the costs of children and the use of contraception tend to change. Although this theory has hitherto found little empirical support, gender inequality seems likely to have some influence on fertility (Oppenheim 1989).

- Change in the Social Institution of Age of Marriage. The age of marriage is embedded in the social structure of a society and affects fertility (Benedict 1972). Revelle (1968) argues that late marriage does appear to reduce fertility. "In Western Europe, until quite recent times, the age of marriage of women was high and many men and women never married. This had a marked effect on lowering fertility". However, he also notes that "in most other societies, the age of marriage does not seem to be significant in affecting fertility".

3. The 'Classical' Demographic Model of Fertility

"It is necessary to be absolutely modern"
Arthur Rimbaud

This section examines the model of a sub-group of demographers, the proponents of the deterministic model of fertility change. I refer to them as 'classical' demographers to distinguish them from 'modern' demographers that subscribe to socio-demographic theories of fertility change. The focus on 'classical' demography reveals quite sharply the differences between the demographic and economic conceptions of reproductive behaviour. I begin with such a comparison and then expose the deterministic theory of fertility.

3.1. Demographic and Economic Paradigms: A Comparison

If economists believe that sociologists make a point in the field of reproductive behaviour, they look at demographers with mixed feelings. For Kirk (1996), economists reached the conclusions that "demography is too important to be left to demographers".

> "Demography evaluates and initially digests the vast reservoirs of social data complied in censuses and vital statistics...Demographers, more than most social scientists, are interested in having their basic data as close to accuracy as possible. It is a question of minimizing errors, and, unlike many social scientists, they know that no measurements are ever exact" (Caldwell 1996)[35].

Despite, or perhaps because of their care to improve their data, demographers' main failing is that they do not have a theory on demographic change[36]. Kirk (1996) summarizes the argument: "demography is a science short on theory, but rich in quantification".

3.1.1. Demographic Paradigm: Hypotheses

The demographic paradigm rests on three hypotheses:

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[35] Caldwell (1996) describes demographers as "inheritors of nineteenth-century positivism"--"positivism...emphasizes the factual position against the speculative, the useful against the idle, the certain against the indecisive, the precise against the vague, the positive as against the negative or critical".

[36] The ethymology of the word *demography* (from the ancient Greek *demos* (society) and *grapho* (describe)) confirms the preeminence of the descriptive approach.

1. Existence of a population equilibrium. Each society converges towards a state of equilibrium. As I will show below, the state of equilibrium in modern societies is characterized by a low level of fertility and mortality. In reality, demographers do not know whether this state of equilibrium ever existed. They only assume that if they proceed in terms of a long enough period of time, they will be able to observe it[37].

2. Uniqueness of the equilibrium. Demography postulates that all societies converge towards a unique state of equilibrium.

3. Predestination in Human behaviour. The mechanism that drives each society towards its equilibrium is beyond its control. Population, and in particular fertility behaviour is pre-determined. The idea of pre-determination is close to the concept of complete determinism in exact sciences. It means that there exist exact and necessary (or 'natural') laws of causation--this is contrasted with 'reasonable expectations' in economics for example.

   For example, demography defines concepts close to the natural laws in exact sciences, such as "natural fertility"[38]. This determinism also transpires in Historical Demography. In this domain, human History is confined to a scaled general model where all societies are placed into a rank-ordered typology in terms of observable economic and demographic characteristics. As Kirk (1944) had put it: "In regard to demographic matters the different countries of the world may be considered as on a single continuum of development."

3.1.2. Demographic and Economic Paradigms: Comparison of Hypotheses

I now compare the hypotheses underlying the demographic paradigm, with those underlying the economic paradigm:

[37] Strictly speaking demography does not claim the existence of an equilibrium but only of a trend toward such an equilibrium. Along that trend, most proximate causes for population changes are assumed constant. This assumption is a necessary condition for the permanent existence of a population system. I explore this point in Chapter III.

[38] This is the 'equilibrium' level of fertility and its value is assumed to be at or above the replacement level.

1. The economic paradigm embodies the concept of 'equilibrium', but not exclusively: economic theory allows for no-equilibrium situations to arise. For example, in adverse selection problems, cases may arise where profitable deviations always exist and the system never settles down (Mas-Colell *et al.* 1995).

2. Economics can derive a 'unique' equilibrium: it can derive 'multiple equilibria' as well. For example, multiple equilibria are often encountered in game theory—an area in economics that studies the strategic behaviour of individuals (Mas-Colell *et al.* 1995)[39].

3. Most importantly, economic theory responds to the idea of 'voluntarism' on behalf of individuals. Economics assumes that individuals have full control over their environment and do not respond to total predestination.

3.1.3. Demographic Paradigm: Further Characterization

This being said, I can apply the typology used above to characterize precisely the demographic paradigm: what is the object of choice? What structures this choice? What principle leads to this choice? It is understood from the discussion above that the term 'choice' is taken loosely here.

3.1.3.1. The Context of 'Choice'

Fertility behaviour responds to superior laws of Nature. There is no decision to make either by individuals, or by society. In Chapter III, I will argue that, although individuals do not decide the number of children, they can decide the timing of births.

3.1.3.2. The Structure of 'Choice'

Constraints to the formation of 'ideals' are the weakest part of the demographic paradigm. Demography assumes the existence of superior laws of Nature, but fails to give insight into the origin of these laws. For economists, this failure invalidates the contribution of demography as a theoretical discipline.

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[39] Game theory uses various tools (called "refinements") to narrow down the number of 'reasonable' equilibria (Hirshleifer and Riley 1992). The multiplicity of equilibria undermines the predictive power of these theories (Kreps and Wilson 1982). I am grateful to Norbert Wunner for this point.

3.1.3.3. The Decision-making Principle: The Darwinian Selection Process

The final outcome results from two inextricably linked processes: first, the struggle for existence—a principle similar to the competition mechanism that results from optimization in the economic paradigm[40]. Second, the natural selection process—the dynamics of the struggle for life leads to a single end result, where only the fittest survive. This Darwinian conception of human action ensures pre-destination in human behaviour[41].

3.1.4. Demographic and Economic Paradigms: Object of Study

Now that I have completed the description of the demographic paradigm, I can contrast the object of study of each: the economic and demographic paradigms. The argument that I briefly outline here will be discussed in details in following chapters.

- Demography is primarily interested in long-term trends, and not in short-term fluctuations in demographic variables. For example, fertility inquiries are dominated by the following questions: what is the average level of fertility to which post-industrial societies are tending? Is a two-child average here to stay? Might the current TFR of 1.8, or even less, become the norm? Or even no children at all (Coleman and Salt 1992). The emphasis on long-term issues, and neglect of short-term fluctuations turned out to be a serious impediment to the understanding of large fluctuations in Western fertility in the last half-century[42].

- In contrast, economics makes relatively few assumptions about long-term equilibrium relationships; economics is primarily concerned with short-term fluctuations.

To conclude, the demographic paradigm does not simply differ from the economic paradigm in its approach to study reproductive choice; it makes up for an entirely distinct paradigm.

[40] An essential difference with the prevailing economic paradigm is that demography excludes cooperative solution as possible optimal outcome.
[41] It could however be argued that economic theory (with its concept of competition) subscribes to a similar conception of human behaviour.
[42] Demography also failed to predict most large fertility changes of this century, notably after the second World War.

3.2. The Adaptation Hypothesis: An Application of the Demographic Paradigm

The original demographic model of Notenstein (1945)[43] predicts that each society will experience an 'adaptation' towards a given equilibrium fertility level. This is often referred as the 'Demographic Transition Hypothesis'.

The model remains vague on what exactly this equilibrium level is. The model only says that the equilibrium fertility level will be 'low and unique'. In reality, the equilibrium fertility level was never observed in actual data. All that can be observed is a long-term trend towards an equilibrium. I will return to this point in Chapter III.

In the process of 'adaptation' towards the equilibrium fertility level, the total fertility rate is expected to fall from its initial 'high' level towards a 'low' level.

For demographers, the decline in the total fertility rate is viewed as a positive long-term indicator of development:

1. It features only 'modern' societies.

   "fertility would only fall as a result of the cumulative mutually reinforcing spectrum of effects consequent on full-scale industrialization and modernization; enhanced survival; a growing culture of individualism; rising consumer aspirations; emergence of huge and socially mobile urban populations; loss of various functions of the family to the factory and the school" (Szreter 1993).

2. It reflects 'increased rationality' on behalf of individuals who make fertility decisions. Because individuals live in a modern society, they become 'more intelligent' and capable of making 'rational decisions' (Caldwell 1982). In contrast, in traditional societies, agents make 'irrational choices', high-fertility being one of them[44].

[43] The 'modernized' version of the demographic transition theory abandoned the more rigorous, unidirectional specification of causal relationships posited in Notenstein's original version.
[44] One can easily infer how this view affected the policy debate on fertility control in developing countries, for instance.

3. It is associated with the prospect of 'Westernization' and adoption of the Western system of values and attitudes. Western social ends—liberalism and democracy, are considered as desirable for each society. Szretzer (1993) summarizes the argument:

> "...the institution of liberal and democratic groundrules in the economic as in the political realm (is)..., in these societies, the necessary precondition for entering the evolutionary path of (demographic) transition".

Once embarked on the process of 'adaptation' towards a modern, rational, and Western fertility level, each society undergoes an irreversible and permanent decline in fertility. This implies, for example, that British society will never return to the average 6 children per family, the fertility standards (or 'ideal family size') in the 1870s.

Although attractive by its simplicity, the adaptation (also referred to as modernization) hypothesis is frequently in dispute with factual evidence. For example, in France, fertility decline within marriage began a century earlier, in the 1780s, without industrialization. In Scandinavia, fertility decline started just a few decades after Britain, although it remained dependent on agriculture, fishing, forestry, and other primary productions (Coleman and Salt 1992).

Table 2.1.

A Summary of Theories of Reproductive Behaviour

	Economic Theory	Sociological Theory	'Classical' Demographic Theory
Key Assumptions			
1. Context of Choice	- individual and conscious decision - actual family size	- social and individual decision - ideal and expected family size	- no decision (Laws of Nature) - ideal family size
2. Structure of Choice	- Preferences (Utility Function) - Prices and Income - Perfect Rationality	- Norms and Values	- biology - 'modernization', 'Westernization' and 'rationality'
3. Decision-Making Principle	- Optimization	- Satisfaction	- Darwinian selection process
Limitations			
	- no predictive power - not falsifiable - uncertainty?	- not falsifiable (circularity)	- no explanatory power
Strengths			
	- formalization - potential for empirical testing	- individual/social complexity	- unambiguous predictions - description of long-term demographic changes ('Demographic Transition Hypothesis')
Policy Implications			
	- sharp fertility decline = negative - effectiveness of pro-natalist		- fertility decline = positive Sharp variation/TFR below replacement level = negative - ineffectiveness of pro-natalist policy.

Conclusions

This chapter explored the most significant contributions to the question of reproductive choice. The field emerges as a collection of quite distinct, often contradictory approaches. The gap between disciplines became so wide that it makes any attempt to relate them extremely difficult. Yet, one of my earliest findings has been that the absence of such a broad approach is handicapping progress in understanding development in the field. In using an interdisciplinary approach, I clarified the reasons for this disagreement.

I compared the three approaches to the topic, i.e. economic, sociological, and demographic, in using three questions: what is the object of the choice? What constraints the choice? What principle leads to this choice? In each case, I established the limitations and strengths. In this part, because of its importance for what follows, I confine myself to highlight the essential differences between the prevailing economic and demographic paradigms (table 2.1) and show that they make up for a fundamentally distinct conception of reproductive behaviour:

- For economists, reproductive choice results from an individual and voluntarist decision-making process. In contrast, for demographers, it is constrained by superior laws of Nature and the Darwinian selection principle. Thus, there is little room for individual choice.

- For economists, reproductive behaviour results from a process of optimization. As such, households will always 'rationally' choose the optimal number of children. For demographers, fertility decisions are not always rational. Typically, in primitive societies, households can make 'irrational' choices, high-fertility being one of them. Rational fertility decisions are only possible in a modern (Western) society.

- For economists, reproductive choices can change in response to variations in both relative prices (cost) of children and income. For demographers, the cause for fertility change lies in a deeply rooted process of 'adaptation' of society towards the equilibrium fertility level. In this framework, the decline in fertility is viewed as a positive indicator of development; it indicates that 'adaptation' is underway.

- In spite of its potential as an elegant theory, the economic theory of reproductive behaviour fails to produce definite predictions, particularly on the effect of income changes on fertility. In contrast, demographic theory generates unambiguous predictions; it predicts that there is an irreversible decline in fertility over time.

- The economic theory of reproductive behaviour cannot be falsified and fails to account satisfactorily for uncertainty. The demographic theory was never validated empirically. The theory fails to explain the causes for 'adaptation'. For economists, this failure invalidates the contribution of demography as a theoretical discipline.

III. The Effect of Shifts in Values and Timing of Births on Fertility: Evidence from Russian Time-Series Fertility Data

"Science is built up of facts, as a house is built up of stones; but an accumulation of facts is no more a science than a heap of stones is a house"
Henri Poincaré

Introduction

There is no single grand demographic explanation on the rapid fertility decline in transition Europe. There are only fragmented pieces of explanations that emphasize the role of adaptation towards Western fertility levels. The purpose of this chapter is twofold: first, to develop a demographic hypothesis on the rapid fertility decline in Russia, and second, to test it on Russian fertility data.

The demographic hypothesis states that the fertility crisis[45] in Russia results from two inter-linked processes: first, the gradual adoption of the Western system of values and attitudes. This system promotes a greater individualism and a lesser desire for large family size. The effect of Transition was exactly similar to a large social shock: it accelerated the adaptation towards the Western system of values and attitudes towards reproduction (the catching-up effect).

Second, the historical lagged-effect of pro-natalist policies in the past. The lagged-effect refers to the births that were brought forward in the 1980s as a result of the pro-natalist policies, but eventually returned to their 'normal' level in the 1990s. For example, in Russia, the government introduced pro-natalist policies in the mid-1980s. The immediate effect of those policies was to reduce the interval between successive births. After the removal of policy-induced additional births, the fertility rate returned to its 'normal' level—this is shown in the current fertility decline.

The outcome of this chapter is threefold: first, a consistent demographic hypothesis of the rapid fertility decline in transition Europe is derived. Second, the importance of attitudinal changes in the fertility decline is tested empirically. Finally, this simple explanation is enriched by adding a second explanatory variable: the shift in the timing of births. Shifts in attitudes (or values) and timing of births constitute what I shall refer to as the demographic hypothesis.

To test this hypothesis, I make use of Russian time-series data[46] from the *Institut National d'Etudes Démographiques* and *Goskomstat*. The data set consists of the annual total fertility rate (TFR) and age-adjusted fertility rates time-series (1960-95)[47]. All data are expressed in natural logarithms.

The scheme of the chapter is as follows: section 1 develops a demographic hypothesis of the rapid fertility decline in Russia. Section 2 introduces structural break analysis and shows evidence of attitudinal changes towards reproduction in Russia. Section 3 tests the demographic hypothesis.

[45] In this context, the term 'fertility crisis' is appropriate. As argued in Chapter I, demographers use the term 'crisis' whenever there is a *sharp* variation over time in the total fertility rate.
[46] This chapter uses the Total Fertility Rate (TFR), rather than the completed fertility, as a measure of the actual family size. The reason is that the construction of the true indicator of fertility would require information that will not be available for decades. This issue is explored in appendix 1.2.
[47] Russia started to develop a universal birth registration system in 1959.

1. A Demographic Hypothesis of the Fertility Decline[48]

There is no grand demographic theory on the rapid fertility decline in transition Europe. There are only fragmented pieces of explanations that emphasize the role of 'adaptation' towards Western fertility levels. This section develops a demographic hypothesis of the 'fertility crisis' in Russia. It extends the analysis of the 'classical' demographic paradigm presented in Chapter II and makes use of two central ideas in demography: adaptation and shifts in the timing of births.

This section first reminds the reader of the meaning of those concepts. It then exposes how those concepts can be used to explain the rapid fertility decline in transition Europe. Finally, it derives its implications for testing.

1.1. The Demographic Concepts of 'Adaptation' and 'Shifts in the Timing of Births'

Demography evolves around two central concepts[49]: first, the 'adaptation hypothesis'. It states that each society progresses from the traditional 'state of population equilibrium' towards the modern 'state of population equilibrium'. Second, shifts in the timing of births. It states that households can decide the timing of births. They can shift (bring forward or postpone) the birth of a child in response to a change in the environment in which they live.

The concept of 'adaptation' (towards a population equilibrium) encompasses a large number of ideas. Based on the discussion in Chapter II, I now remind the reader of the essential features of the hypothesis. I focus on its implications for fertility (TFR).

1. Theoretically, there is an equilibrium fertility level. In reality, this equilibrium was never observed: actual data only reflects the long-term trend towards that equilibrium[50]. Along that trend, proximate causes for fertility changes are assumed to be constant.

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[48] This chapter focuses on the 'classical' demographic paradigm for it delivers a relatively simple hypothesis to test. It ignores the 'modern' paradigm that adds to the simple demographic model, sociological and economic factors.

[49] This part offers a systematic and formal *interpretation* of the two concepts that emerges from the extended reading of demographic articles on fertility.

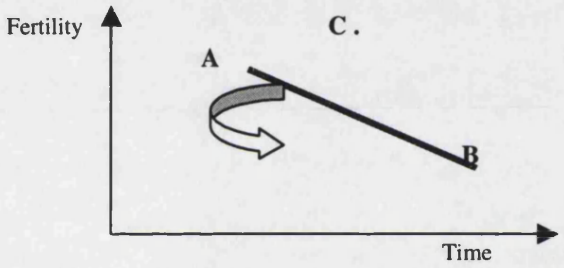
[50] The long-term fertility trend is used to proxy the 'fertility standard', 'ideal family size' or 'normal' TFR.

2. There are technically two states of equilibrium. One that is prevalent in 'traditional societies' and the other in 'modern societies'. The adaptation hypothesis gives the level of fertility corresponding to each society. In traditional society, the equilibrium fertility level is 'high', while in modern societies the equilibrium fertility level is 'low'. Thus, a low fertility level is an inherent feature of a modern society.

3. Evolution implies a shift away from tradition towards modernity. In particular, it triggers a shift away from a high fertility level towards a low fertility level. Thus, adaptation towards modernity implies a decline in fertility. Fertility decline is a long-term positive indicator of development for a society.

I now further characterize the process of adaptation (Figure 3.1). First, the dynamics of fertility over time, i.e. the move from the traditional fertility level (A) to the modern fertility level (B) defines the 'fertility path'. Empirically, this path corresponds to the long-term fertility trend. Second, the dynamics of fertility over time is uni-directional. There is only one way for a society to move over time: it is by going from A to B. Alternative fertility paths such as from A to C (with a rising fertility level), followed by C to B (with a declining fertility) are excluded.

Figure 3.1: The Fertility Rate over Time



Third, the decline in fertility over time, i.e. the move from A to B, is irreversible. Each society necessarily goes from A to B. The fertility rate of a modern society (B) will for instance, never revert to A. The direction for the course of fertility history is set and fixed forever[51].

[51] As argued in chapter II, the pre-deterministic nature of the process is consistent with the Darwinian conception of human behaviour that characterizes the 'classical' demographic paradigm.

Finally, although demography remains elusive on this aspect, the process of adaptation can, in some circumstances, be accelerated—the so-called catching-up effect. For example, a large social shock to a population can hasten the speed of convergence towards the equilibrium level. In that case, the catching-up effect will be shown in the accelerated decline in fertility.

The interesting question concerns the mechanisms through which 'adaptation' takes place. Demography assumes that 'adaptation' goes through the adoption of a new system of values and attitudes[52]. This system promotes a greater individualism, increased awareness of the opportunity cost of time, and a lesser desire for larger family size.

In the adaptation process, individuals have little choice. In fact, 'classical' demography assumes that individuals do not really choose the number of children: society and the laws of Nature set for individuals the fertility standard (ideal family size).

Individuals (or households) can only choose the timing of the births (or interval between successive births). This means that they can shift (bring forward or postpone) the births in response to changes in the environment in which they live. For example, they can decide to reduce the interval between successive births of planned children when large maternity benefits are introduced.

In anticipation of section 1.3, I argue that the concepts of adaptation and shift in the timing of births are closely connected to one another. On the one hand, adaptation implies the existence of a long-term fertility trend. By nature, the 'fertility trend" is stable over time. On the other hand, the actual TFR can fluctuate a lot if individuals often shift the timing of births. In this case, the actual fertility level can rise above the fertility trend or fall below it. Yet, in the long term, it will revert to the fertility trend. I will return to these ideas below.

[52] As shown in chapter II, the concept of 'values and attitudes' can be related to the concept of 'tastes' (and utility) in economics.

1.2. A Demographic Hypothesis on the Fertility Decline in Russia

I now apply the concepts of adaptation towards Western fertility standards and shifts in the timing of births to the Russian case.

1.2.1. The Catching-up Effect

In the early 20th century, traditional family patterns prevailed in Russia. Typically, women were getting married between the ages of 15 and 18 and expected a first child soon after. Women would generally have 3 to 4 children in the course of their life. The average rural family comprised 5.6 persons; early and almost universal marriages prevailed (INED 1996).

Throughout the post-war period, and especially in the 1970s and 1980s, significant changes in the family behaviour led some Russian demographers to argue that Russia was undergoing an 'adaptation' towards Western fertility standards. For Vishnevsky (1996a), "the postwar decades became a period of increased convergence in the evolution of the family and demographic behaviour across Russia and the West (particularly the United States). This is confirmed by the various indicators of family size and composition, family cycle, nuptiality, divorces, fertility, living arrangements, etc...". For example, the share of the two-member families rose, whereas the proportion families with five or more members steadily increased (INED 1996)[53].

What has been the impact of transition on family patterns? I will assume the following: prior to transition, Russia was isolated from the West. Transition coincided with the opening of the East to the West. This in turn led to the rapid replacement of the Eastern system of values and attitudes by the Western system of values and attitudes.

What this Western system of values and attitudes represents is far from obvious. In general, Western values encompass rising emphasis on individualism, privatization of formerly community interest and ownership, and the spread of consumerism as the basis of individual ambition (Hall and White 1995). Western attitudes towards family formation encompass a lesser desire for large family. For the Council of Europe (1993), "individualistic Western values involve the rejection of conventional social norms, greater

[53] At the same time, the postwar decades were marked by the preservation of numerous traditional features. These include, for example, the maintenance of traditionally early and almost universal

personal and sexual freedom and higher valuation of the opportunity cost of the consumption foregone due to the birth of a child". To sum up, Western attitudes towards reproduction mean fewer children.

Transition was similar to a large social shock on the population. In particular, it accelerated the adaptation process towards Western fertility levels. In the absence of transition, the fertility level would have slowly declined over time. Transition accelerated the decline in fertility.

1.2.2. The Lagged-Effect

Even if I assume that there was a large social shock to the population, the attitudes towards reproduction cannot have radically changed overnight. I need an additional factor to account for the sharpness of the decline. I find this factor in the history of the country.

In the 1980s, the Russian government introduced pro-natalist policies. For Zakharov and Ivanova (1996b), the immediate effect of these policies was to reduce the interval between successive births, while leaving attitudes towards reproduction unchanged. Specifically, households wanted the same number of children as before these policies were introduced. Households simply brought forward the births of children they had planned to have. For example, in the absence of pro-natalist policies, they would have had two children, one in 1985 and the other in 1990. Under pro-natalist policies, they had one child in 1985 and the other immediately after.

In this vein, looking at the actual TFR can give a very misleading picture of reproductive decisions. If the TFR rose in the mid-1980s, it does not necessarily mean that households decided to have *more* children. In fact, they may not have changed their attitudes towards reproduction; they may simply have brought forward the births of their planned children. Also, the current fall in the TFR does not necessarily mean that households decided to have *fewer* children. This may simply reflect the removal of policy-induced additional births and a return to the 'normal' level of fertility. I refer to the latter as the lagged-effect of pro-natalist policies.

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marriages, relatively early fertility, and the predominance of abortion as a main method of family planning (INED 1996).

1.3. Implications for Empirical Testing

The challenge of this chapter is to translate theoretical ideas into statistical concepts that can be applied to actual data. To establish such a link, it is necessary to make a number of assumptions. In this part, I explore how I intend to detect empirically shifts in values and timing of births.

1.3.1. Shift in Values and Structural Break in the Fertility Trend

The total fertility rate follows a long-term trend. Along that trend, the proximate causes for fertility changes are assumed constant. I will assume that the fertility trend can be used to proxy for the attitudes towards reproduction[54].

If the fertility trend reflects the attitudes towards reproduction, and those attitudes are expected to have suddenly changed in the process of accelerated adaptation, I should observe at a particular point in time the rise of a new fertility trend. Thus, the study of the fertility trend over time can give insight into a possible change in attitudes.

In econometrics, structural break analysis helps to detect changes in the behaviour of a long-term trend. For our purpose, this technique is useful to find out whether fertility data is consistent with the declining fertility trend of the 1980s or a new fertility trend in the 1990s.

1.3.2. Shifts in Timing and Fluctuations around the Fertility Trend

By assumption, attitudes towards reproduction are reflected in the long-term fertility trend. If attitudes do not change, the fertility trend will not change either. Thus, if actual fertility data rises above or falls below the trend, but always reverts to the trend in the long term, it will represent a shift in the timing of births.

The idea of fluctuations around a long-term trend has been applied in Business Cycles theory (Lucas 1983). According to this theory, output fluctuates around a long-term trend (the 'natural output'), but there is an inherent propensity for output to revert to this trend in the long term. This chapter will test whether fertility behaves in a similar way as output (long-term trend and regular fluctuations around that trend). I will use

[54] It is also used to proxy for 'values'. In what follows, I ignore the distinction between values and attitudes and use both terms interchangeably.

techniques that are currently applied to output time-series to test the empirical validity of this deterministic trend model.

To sum up, testing the demographic hypothesis consists of verifying the existence of (1) a structural break in the long-term fertility trend (Section 2); and (2) a deterministic (breaking) trend, with fluctuations around that trend (Section 3)[55].

[55] As I will discuss in Section 3.3, I will test the deterministic trend model (with regular fluctuations around the trend), but not the historical lagged effect of Russian pro-natalist policies in the 1980s.

2. Shift in Values: Empirical Evidence

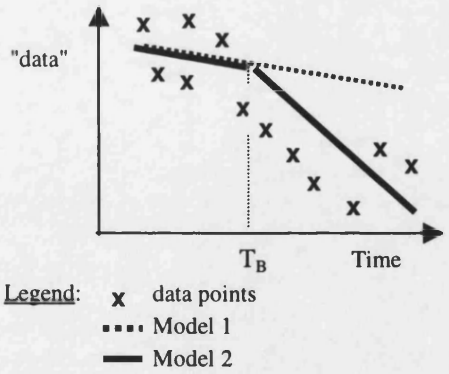
This section tests for shifts in values and subsequent change in the attitudes towards reproduction in the 1990s in Russia. I use age-adjusted and total fertility rates time-series data (Goskomstat 1996 and INED 1996, 1998)[56].

2.1. Preliminary Econometric Concepts

The first concept relates to the dummy variable. In general, a dummy variable is defined to take only two possible distinct values, zero or 1. This variable reflects a simple 'yes or no' situation. For example, a dummy can be used to account for the fact that some individuals are confident about the future, and others are not. The dummy variable takes the value of 1 if the individual is confident and 0 if not.

The second concept concerns the structural break. A structural break is technically a change in the slope (or the intercept, or both) coefficients in a subset of data. For example, if we study the USA output series over the period 1910-1970, which includes two wars and one Depression, we may expect that these events affected the output trend. Assuming a constant parameter structure in the regression for the whole period is not reasonable. A more adequate model would allow for a different slope (or intercept) in a subset of data (Pindyck and Rubinfeld 1991).

Figure 3.2: Statistical Representation of Data over Time



Econometric studies have used dummies to account for shifts in either slope, or intercept or both--the so-called structural break dummy (D_t). In general, the dummy variable takes the value of zero for any period before and at the time of the structural break; and takes the value of 1 after the structural break.

[56] In a preliminary inquiry on attitudinal changes, I examined survey data, but was unable to conclude satisfactorily. Vciom data suggested that, if one uses the ideal number of children to proxy for attitudes towards reproduction, there was a remarkable change in a short period of time: it fell between 1991 and 1992 by 27 percent and returned to its 1991 level less than two years after (Vishnevsky 1996b). In contrast, RLMS 1992 data suggested that there was no attitudinal change:

A simple example is drawn in figure 3.2. Time-series data can be represented by at least two models[57]. The first model, quite unsatisfactorily passes a straight and continuous line through the points. This specification misses one very important feature of the data behaviour: time-series data did not fall continuously over time, but fell with greater rapidity at one particular point in time, T_B. At that point, the slope of the straight line abruptly decreased. To capture the discontinuity at T_B and the subsequent change in the slope, I specify a second model. This model adds to the first specification an explanatory variable, the structural break dummy D_t. I define the dummy as follows: D_t takes the value 0 prior to the break (T_B) and 1 after (Pindyck and Rubinfeld 1991).

Model 1:	$F_t = \beta_1 + \beta_2 . T$
Model 2:	$F_t = \beta_1 + \beta_2 . T + \beta_3 . T . D_t$
	where $D_t = 0$ if $t \geq T_B$; and 1 otherwise

The second model has the following implications:

1) For years before the break ($D_t = 0$), the regression (fitted) line has the form:

$$E(F_t) = \beta_1 + \beta_2 . T \qquad (1)$$

2) After the break ($D_t = 1$), the regression line has the form:

$$E(F_t) = \beta_1 + (\beta_2 + \beta_3) . T \qquad (2)$$

In equation (1), the slope of the Trend, T before the break, is β_2. After the break, the slope of the regression line changes to $(\beta_2 + \beta_3)$. Model 2 is referred to as the 'changing slope model'[58].

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only 1 percent cited interference with their educational or career aspirations as the main motivation for fewer children (Cornia 1995).

[57] I model data with the restriction that the line being estimated is continuous.

[58] Technically, the structural break can take the form of a change in either the slope or the intercept (or both). I tested the nature of the structural break on Russian fertility data and concluded that a change in the slope provided the best statistical representation of Russian fertility data. I then followed Perron (1989) to model a *gradual* change in the trend (the structural break dummy takes the value of 0 prior to the break; and $D(T_B)_t = t - T_B$ after the break). However, the results are not significantly affected when taking the simpler specification described in the text (abrupt change in the trend).

Now that I have specified the form of the regression model, I have to determine how well this model fits with the data. In econometrics, the adequacy (or fitting) of the model is assessed by looking at the significance of each coefficient in the model.

The significance of coefficients is measured by the probability that they are different from zero. Specifically, a statistic, the so-called t-test statistic, is computed assuming that the coefficient is equal to zero (the null hypothesis is $\beta_i = 0$). The t-test statistic is then compared with the standard value t_{crit}[59]. There are two possible outcomes: 1) reject the null hypothesis if the t statistic is greater than t_{crit} or less than $-t_{crit}$, or 2) fail to reject if the t statistic lies between t_{crit} and $-t_{crit}$ (Dougherty 1992).

2.2. Empirical Findings[60]

I now test for a structural break in the Russian fertility trend. The dependent variable is the total fertility rate (Goskomstat 1996 and INED 1996, 1998). I obtained the following results:

1) The coefficient of the 1992 structural break, $D(T_{92})_t$ is significant at a level of 1 percent. This result suggests that the start of transition (1992 price liberalization) coincided with the emergence of a new fertility trend. More specifically, the total fertility rate slowly declined up to 1992, and sharply accelerated its fall after 1992.

$$\text{Fertility}_t = \underset{(4.84)}{13.929} \; \underset{(-4.59)}{-0.001\,T} \; \underset{(-4.81)}{-0.116\,D(T_{92})_t} \qquad \textit{(t-test in parenthesis) (*)} \qquad (1)$$

$R^2 = 0.717$ 35 observations

(*) all coefficients are significant at a 1 percent significance level.

2) I examine an alternative model to check whether the largest structural break in the fertility trend did actually take place in 1992. After carrying out several regressions, I detected a significant break in the fertility trend in 1989 as well.

[59] The t_{crit} is computed at given degrees of freedom and significance level.

[60] Structural break analysis was applied to crude demographic data of Central and Eastern European countries by, *inter alia*, Cornia and Paniccia (1996b). However, as I will show below, their model (deterministic with breaking trend) does not provide the best fit to Russian fertility data. In a preliminary stage, I apply this method to detect the year of the break. Indeed, most testing strategies proceed on the ground of an *a-priori* (known) break (Perron 1989).

$$\text{Fertility}_t = 8.762 - 0.001\,T - 0.064\,D(T_{89})_t \quad (2)$$
(3.35) (-3.07) (-7.22) (t-test in parenthesis)(*)

$R^2 = 0.814$ 35 observations

(*) all coefficients are significant at a 1 percent significance level.

Is the evidence of two structural breaks in the fertility trend a serious drawback for the rest of the analysis? The answer is negative. Empirical results obtained on both structural break dummies indicate that both years 1989 and 1992 were marked by a significant change in the fertility trend from the past. The key question is whether both structural breaks are equally significant.

To assess the comparative importance of both breaks I run a third regression that contains both breaking dummies. I find that the 1992 dummy is no longer significantly different from zero. This means that the slope of the fertility trend broke in 1989. This would suggest that attitudinal changes towards reproduction took place as early as 1989.

$$\text{Fertility}_t = 8.342 - 0.001\,T - 0.07\,D(T_{89})_t + 0.025\,D(T_{92})_t \quad (3)$$
(3.07) (-2.81) (-4.11) (0.64) (t-test in parenthesis)(*)

$R^2 = 0.817$ 35 observations

(*) all coefficients are significant at a 1 percent significance level, except $D(T_{92})_t$

This finding challenges previous studies in the following way:

1. My preliminary findings (Vandycke 1996). In using the crude birth rate, I falsely concluded that the 'fertility crisis' started *before* 1989[61]. It now appears that, if one abstracts from the age-sex structure of the population and uses the total fertility rate, the 'fertility crisis' started around 1989.

2. Cornia and Paniccia (1996b) empirical study. They suggested that the fertility crisis in transition economies coincided with the introduction of market reforms. Specifically, they argued that "the test (of predictive failure) would improve if, instead of using 1989 as a general pre-transition baseline, country-specific baselines reflecting more accurately the introduction of market reform in each specific situation were used". If this had been the

[61] See chapter I.

case—and I showed that it is not, the 1992 structural break (start of the price liberalization) would probably have been the most significant structural break for Russia[62].

[62] In the same vein, in a response to Eberstadt (1994)'s alarming article on the role of transition (and unification) in the fertility crisis of GDR, Ellman (1997) uses preliminary evidence to show that both events are only imperfectly related. Ellman shows the crude birth rate fell by 18 percent between 1980-89 and concludes that the downward trend in the crude birth rate in Eastern Germany took place *prior* to the political and economic collapse of the GDR.

3. Shifts in Values and Timing of Births: Empirical Evidence

This section uses stochastic (unit root) analysis to conclude on the existence of regular fluctuations around the trend. Because the testing procedure is complex, I left the formal exposition in appendices[63]. In this section, I confine myself giving the intuition of the approach and the empirical findings.

3.1. Intuition behind the Testing Procedure

The purpose of this section is to find an appropriate statistical representation (or model) of fertility data over time[64]. I define two possible models:

1. Model 1 assumes that fertility data behave 'randomly' over time. In this case, the fertility rate does not simply follow a long-term trend, with regular fluctuations around that trend. At best, the fertility rate observed at time *t*, can be related to the fertility rate observed at time *(t-1)*, but not to earlier years. This model is referred to as 'stochastic (trend)'[65].

2. Model 2 assumes that fertility data behave in a 'predictable' way over time. The fertility rate follows a long-term trend, and there are regular fluctuations around that trend. This model is referred as 'deterministic trend'. Moreover, using findings of a known structural break in the trend in 1989, I can define model 2 as the 'deterministic breaking trend' model. This model is the (approximate) statistical representation of the demographic hypothesis.[66]

I test model 1 against the alternative model 2. In particular, I test whether fertility data follow a stochastic behaviour against the alternative of a 'deterministic trend with a structural break in 1989'.

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[63] Appendix 3.1 formally exposes the testing procedure.

[64] The starting point of these specifications is the recognition that fertility time-series are non-stationary. In the first model, non-stationarity arises from the fact that the observation at time t depends on the past (t-1), while in the second model, from the fact that it depends on a Trend. Appendix 3.2 tests the stationarity of Russian total and age-adjusted fertility data.

[65] The term 'stochastic' comes from the Greek and means *pertaining to chance*. In this case, the term stochastic trend refers to variables that exhibit "systematic variations", although "hardly predictable" (Maddala and Kim 1998).

[66] As discussed in section 3.3, I will not test precisely the historical lagged effect of pro-natalist policies in the 1980s, but the presence of a reversion to the trend.

There are two possible outcomes to this testing procedure:

1. I fail to reject the 'stochastic model'. In this case, it means that the demographic hypothesis of the fertility decline (long-term trend and regular fluctuations) does not provide the best fit to fertility data.

2. I can reject the 'stochastic model'. This outcome is the worse in two respects: first, it does not tell me whether the demographic hypothesis adequately represents fertility data; and second, it does not tell me the appropriate statistical representation of fertility data over time.

3.2. Empirical Findings

The findings are reported in table 3.1 and can be summarized as follows:

- I found insufficient support for the (proxy of the) demographic hypothesis of the fertility decline in Russia. Specifically, I fail to reject the stochastic model for almost all fertility series (with the exception of the first two age-adjusted fertility series). This suggests that fertility data behave randomly: they cannot simply be represented by a deterministic breaking trend model.

- Two age-adjusted fertility rates series (of women below the age of 24) follow a distinct pattern. Indeed, for these two series, the 'stochastic' model can be rejected. In other words, these series do not behave randomly. This is as far as I can conclude from this finding. As indicated above, I cannot infer that these series follow therefore a 'deterministic breaking trend' model, and I cannot tell what is the appropriate statistical model for these series.

Table 3.1

Tests for Unit Roots in the presence of Structural Breaks, Russian Fertility Data, 1960-95

$$x_t = \mu + \gamma T + \kappa D(T_B)_t + \rho x_{t-1} + \Sigma^{k}_{i=1} \delta_i \Delta x_{t-i} + \nu_t$$

T_B = 1989	k	μ	t_μ	γ	t_γ	κ	t_κ	ρ	$t_{\rho=1}$	$\sigma(\nu_t)$
Total Fertility rate	1	1.935	1.430	-0.001	-1.310	-0.019	-2.650	0.726	-3.046	0.026
Age-adjusted Fertility rate										
< 20 years	1	-53.571	-8.890	0.028	8.900	-0.048	-8.260	0.178	-8.812(*)	0.029
20 to 24 years	1	-1.407	-1.390	0.001	2.820	-0.034	-4.590	0.515	-4.443(*)	0.019
24 to 29 years	1	5.492	2.670	-0.002	-2.406	-0.012	-1.302	0.765	-2.612	0.034
29 to 34 years	3	11.402	2.800	-0.005	-2.710	-0.015	-1.125	0.719	-2.975	0.040
34 to 39 years	3	16.558	3.030	-0.007	-3.010	-0.003	-0.359	0.757	-3.179	0.045
39 to 44 years	1	28.919	3.260	-0.014	-3.270	0.001	0.034	0.731	-3.388	0.066
< 20 to 49 years	1	0.649	0.446	0.001	0.034	-0.016	-2.085	0.828	-2.928	0.029

(*) the value of the t-statistic for the estimated ρ are larger than the critical value –3.82 at the 5 percent significance level.

Notes: all variables (except the Trend and $D(T_B)_t$) are expressed in natural logs. k represents the number of lags. $\sigma(\nu_t)$ is the standard error of the regression. There are 36 observations.

Interpretation: All series (with the exception of the first two-adjusted fertility series) are characterized by a stochastic trend (or are DSP). Indeed, the value of the t-statistic for the estimated ρ is smaller than the critical value: the null hypothesis (DSP) cannot be rejected.

Sources: Goskomstat (1996), INED (1996, 1998) and author's own computation.

3.3. Further Discussions

Finally, I discuss the limits of the testing procedure[67]. First, the method I applied tested the demographic hypothesis only imperfectly. Indeed, due to the current techniques available in econometrics, I could not test, specifically, whether the current fertility decline resulted from the historical lagged effect of pro-natalist policies in the 1980s. I only tested the much broader idea of reversion to a deterministic trend (or regular fluctuations around a trend). Thus, the method I applied is only a preliminary step in the application of stochastic analysis to demographic data.

Second, the statistical procedure may appear inappropriate. In an ideal world, I should have tested the deterministic breaking trend model, a proxy for the demographic hypothesis, against the alternative stochastic trend model. This hypothesis-testing exercise would have then led to either reject or accept the demographic hypothesis.

Unfortunately, stochastic (unit root) analysis proceeds the other way around. It tests whether fertility time-series data follow a stochastic trend, against the alternative of a deterministic breaking trend. Again, the testing-procedure was essentially constrained by the current state of knowledge in econometrics. The techniques (and critical values of the limiting distribution) have not yet been developed: it is technically impossible to test directly the deterministic breaking trend model.

The key question is whether this limitation poses a serious challenge to my findings. My answer is that this limitation is more apparent than real. Although I did not test *directly* the (proxy for the) demographic hypothesis, I tested it *indirectly*. Indeed, for almost all series, I was unable to reject the stochastic model. This means that fertility series appear to be more adequately represented by a stochastic model, rather than by a deterministic (breaking trend) model[68]. It also means that reproductive behaviour is a complex phenomenon, probably even more than the demographic hypothesis would suggest.

[67] Appendix 3.1 discusses other limitations of the testing strategy.
[68] It is beyond the scope of this chapter to evaluate the meaning of a 'stochastic model'. Some argue that it simply means that data cannot be explained, while others like Dolado, Jenkinson and Sosvilla-Rivero (1990) argue that data can be consistent with a Rational Expectations behaviour.

Conclusions

This chapter developed and tested a (proxy for the) demographic hypothesis of the fertility decline, by using Russian aggregate and age-adjusted fertility time-series data. It started with the observation that there is no single grand demographic theory of the fertility decline in transition Europe, but only fragmented pieces of explanations that emphasize the role of 'adaptation' towards Western fertility levels. Thus, I developed a demographic hypothesis, starting from two central concepts in demography: adaptation and shifts in the timing of births.

The demographic hypothesis states that the rapid fertility decline in Russia results from two inter-linked processes. First, an accelerated adaptation towards Western fertility levels (the catching-up effect). This accelerated process took place through a rapid change in attitudes towards reproduction. Second, a historical shift in the timing of births (the lagged-effect).

I then translated this hypothesis into statistical concepts that could be applied to actual data. To establish such a link, I made two assumptions: first, the long-term fertility trend can be used to proxy the attitudes towards reproduction. Second, fluctuations of fertility data around the fertility trend represent shifts in the timing of births.

Using structural break analysis, I first tested whether there is evidence of attitudinal shifts towards reproduction. I concluded for such a change, based on the finding of a significant structural break in the fertility trend in 1989.

Using stochastic (unit root) analysis, I then tested the full demographic hypothesis. In particular, I tested whether fertility data follow a 'stochastic trend' against the alternative of a 'deterministic trend with a structural break in 1989'. For almost all series, I found that fertility data behave randomly; they cannot simply be represented by a long-term deterministic (breaking) trend. Thus, preliminary Russian evidence provides insufficient support to the demographic hypothesis.

The approach used in this chapter is only a first step in the direction of testing a consistent demographic explanation of the fertility decline on actual data, by using recently developed econometric techniques. It is impeded by both technical and knowledge-based limitations in econometrics.

Appendix 3.1

Hypothesis-Testing Procedure Against Shifting Trend Functions: Formalization and Limits

This appendix presents the econometric techniques used to test the demographic hypothesis. The techniques discussed are aimed at finding the appropriate statistical representation of fertility time series[69]. The use of those techniques is complex, while their outcomes may appear limited. We stand here at the edge of fundamental research in econometrics.

3.1.1. Pre-Requisite: Stationarity and Non-Stationarity

From a theoretical point of view a time series is a collection of random variables $\{x_T\}$. Such a collection of random variables ordered in time is called a stochastic process (Maddala and Kim 1998).

Whenever the time series $\{x_1, x_2, x_3 \ldots x_T\}$ has been generated by a stochastic process, it means that each value in the series is drawn randomly from a probability distribution. In modeling such a process, I attempt to describe the characteristics of its randomness. One important property is whether the underlying process that generated the series can be assumed to be *invariant with respect to time*. If the stochastic process is fixed in time, i.e. if it is stationary, this means that the process is assumed to be in equilibrium about a constant mean (expectation) level[70]. The probability of a given fluctuation in the process from that mean level is assumed to be the same *at any point in time*.

In economics, most time series are not non-stationary. The GNP, for example, has for the most part been growing steadily, and for this reason alone its stochastic properties in 1980 are different from those in 1933.

Technically, a stationary time series shares the following properties:

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[69] For a detailed theoretical treatment, see Harvey (1990), Pindyck and Rubinfeld (1991) and Maddala and Kim (1998).

[70] Technically, a time series is said to be strictly stationary if the distribution of the stationary process remains unchanged when shifted in time by an arbitrary value *k*. Thus the parameters that characterize the distribution of the process does not depend on t, but on the lag *k* (Maddala and Kim 1998).

1) the variance of x_t is finite and does not depend on t;
2) the error term υ_t has only a temporary effect on the value of x_t;
3) x_t fluctuates around its mean of zero;
4) the auto-correlation r_k decreases steadily in magnitude for large enough *k*.

A non-stationary time series (or integrated of the first-order, I(1), because the series becomes stationary after first-differencing) shares the following properties:

1) the variance of x_t goes to infinity as t goes to infinity;
2) an innovation υ_t has a permanent effect;
3) the auto-correlation $r_k \rightarrow 1$ for all *k* as *t* goes to infinity. A typical non-stationary process is a random walk (where the coefficient on the lagged term is equal to unity).

Economic theory generally deals with equilibrium relationships. Thus the majority of economic theory is built upon the assumption of stationarity[71]. Given that in practice most economic time series are non-stationary and the objective is to model these series, one will have to transform data into stationary processes. The transformation of all data in natural logarithm can be used to neutralize the variability in the *variance* of the series (Mills 1993). After transformation, one is often left with variability in the *mean* of the series.

3.1.2. The Dickey-Fuller (DF) Testing Strategy

The non-stationary behaviour of time series emanates from two sources:

1. The series depends on its past—a random walk process (or a process that is stationary in first differences: a difference-stationary process, DSP). In this case, x_t is a direct function of its own past x_{t-1} and a random error v_t, with constant mean and variance. It is clear that the process x_t has no constant mean, and is therefore non-stationary. However, a simple rearrangement

[71] For example, both Keynesian and Classical macroeconomists assume that output movements can be explained by a slowly growing natural trend and transient deviations around that trend. In technical terms, they assume that output follows a trend-stationary process. This implies in particular that any shock to output will generate *temporary* deviations from the natural trend. In a pioneering study, Nelson and Plosser (1982) show that this is not the case: output tends to follow a stochastic trend (or DSP process), so that shocks will have long-standing effects on output. As can

could make it stationary: each successive *change* (or differencing) in x_t (i.e. $\Delta x_t = x_t - x_{t-1}$) is drawn independently from a probability distribution with constant mean ($E(\Delta x_t) = E(v_t) = 0$). First-order differencing of the series leads to stationarity of the series.

$$x_t = x_{t-1} + v_t \qquad \text{where } E(v_t) = 0 \text{ and } E(v_t v_s) = 0 \text{ for } t \neq s$$

2. The series depends on a Trend—a trend-stationary process (or a process that is stationary around a trend: TSP). In this case, x_t is function of a trend (T) and a random error υ_t, with constant mean and variance. Here again, the process has no constant mean, because of the trend component.

$$x_t = T_t + \upsilon_t \qquad \text{where } E(\upsilon_t) = 0 \text{ and } E(\upsilon_t \upsilon_s) = 0 \text{ for } t \neq s$$

The technique used to transform this non-stationary series into a stationary one is a little more complex. It includes to regress x_t over T_t in order to derive the so-called "de-trended" series $\{x_t^T\}$. The de-trended series is stationary.

To sum up, the following two models can be specified:

Difference-Stationary (DSP): (or Stochastic Trend)	$x_t = x_{t-1} + v_t$ or $\Delta x_t = v_t$	(1)
Trend-Stationary (TSP): (or Deterministic Trend)	$x_t = \beta T + \upsilon_t$	(2)

where Δ denotes the first-order time difference (i.e. $\Delta x_t = x_t - x_{t-1}$), T = deterministic Trend and v_t , υ_t = i.i.d errors.

In a large sample at least, each specification has different statistical properties and economic implications. Differences arise from the fact that a shock to (1) has permanent effects on the series x_t; while a shock to (2) has only short-lived effects: in the long-term, the series will revert to its trend value.

For our purposes, the demographic model described in Section 3.1 assumes that fertility series follows a deterministic trend (TSP), with only short-lived fluctuations

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be seen from this example, the question of stationary is particularly relevant in the discussion on the welfare costs and benefits of policy interventions.

around the trend. An alternative model is that fertility series follows a stochastic trend (DSP).

I now formally present the strategy to test the DSP model against the TSP model. This procedure (often referred as 'unit root' for the coefficient of x_{t-1} is equal to 1 in the DSP model) was proposed by Dickey and Fuller (DF). Formally, I run the following regression[72]:

$$x_t = \rho\, x_{t-1} + v_t \qquad (3)$$

or subtracting from each side of the equation (3) x_{t-1} to obtain the first-difference form:

$$\Delta x_t = (\rho - 1)\, x_{t-1} + v_t \qquad (4)$$

where v_t is an i.i.d. error process[73].

Under the null hypothesis, we test for unit root (or $\rho = 1$). The obvious test-statistic is the usual 't-ratio' of the estimate of $(\rho - 1)$ to its estimated standard error. Dickey and Fuller show, however, that this test-statistic does not have the conventional distribution and the correct values must be simulated. Several papers, including Dickey and Fuller (1979), do just this.

In an extension of this simple testing-procedure, Dickey and Fuller propose to consider the null hypothesis that a time series has a unit root with possibly non-zero drift (β) against the alternative that the process is 'trend-stationary'. Formally, the null hypothesis is:

$$H_o: \quad x_t = \beta + x_{t-1} + v_t, \qquad (5)$$

The alternative hypothesis is:

$$H_1: \quad x_t = \alpha + \beta T + \upsilon_t \qquad (6)$$

[72] The test assumes that only auto-regressive (AR) terms are required to obtain satisfactory representations.

[73] The error process is i.i.d (or independent and identically distributed) if it features low auto-correlation r_1 in the residuals and low standard error $\sigma(v_t)$.

Their testing-strategy is to embed both hypotheses in a common model and run the following regression:

$$x_t = \mu + \gamma T + \rho x_{t-1} + \nu_t \qquad (7)^{74}$$

Equivalently in first-difference form:

$$\Delta x_t = \mu + \gamma T + \theta x_{t-1} + \nu_t \qquad (8)$$

In regression (7), I test whether $\rho = 1$ and $\gamma = 0$. Equivalently, in first-difference form, the unit root test consists of verifying whether $\theta = 0$ and $\gamma = 0$.

3.1.3 Extension of the DF Strategy: The Perron Testing Strategy

The DF procedure is invalidated in the presence of breaking trends: "Standard tests of the unit root hypothesis against trend stationary alternatives cannot reject the unit root hypothesis if the true data generating mechanism is that of stationary fluctuations around a trend function which contains a one-time break" (Perron 1989). A new test statistic that distinguishes between the two hypotheses when a break is present has to be applied on data. Perron (1989) developed such a test-statistic, with a corresponding statistical distribution.

The Dickey-Fuller (DF) testing strategy is extended to ensure a consistent testing procedure against shifting trend function. Let me first return to the initial DF regression:

$$x_t = \mu + \gamma T + \rho x_{t-1} + \nu_t \qquad (7)$$

I now introduce in (7) the possibility of a shift in the slope of the function at a single point in time. For that purpose, I define the time of break as T_B, i.e. the period at which the change in the parameters of the trend function occurs, and a structural break dummy variable $D(T_B)_t$. The dummy variable takes the value of zero before the break, and, following Perron (1989), takes an increasing value thereafter as follows: $D(T_B)_t = t - T_B$ if $t > T_B$[75].

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[74] It can be shown that models (5) and (6) are special cases of $x_t = \alpha + \beta T + \nu_t / (1 - \phi L)$; with L = lag operator. Under model (6), $|\phi| < 1$. Under model (5), $\phi = 1$.

[75] This specification allows for a transition period during the change in the trend function. This formulation reflects the possibility of a gradual, rather than an abrupt change in attitudes.

I am interested in testing for unit root, against the alternative of stationary fluctuations around a deterministic breaking trend function. Formally, the null and alternative hypotheses can be defined as follows:

$$H_o: \quad x_t = \mu + \rho\, x_{t-1} + \nu_t \tag{9}$$

$$H_1: \quad x_t = \mu + \gamma_1\, T + (\gamma_2 - \gamma_1)\, D(T_B)_t + \nu_t \tag{10}$$

The testing strategy is to embed both hypotheses in a common model as follows:

$$x_t = \mu + \gamma\, T + \rho\, x_{t-1} + \kappa\, D(T_B)_t + \nu_t \tag{11}$$

To test for unit roots, the null hypothesis is $\rho = 1$, and $\kappa = \gamma = 0$.

An extension is necessary to allow for the innovation sequence $\{\nu_t\}$ to be serially correlated. One approach suggested by Perron is to add extra lags of the first differences of the data as regressors. The final regression to run is:

$$x_t = \mu + \gamma\, T + \kappa\, D(T_B)_t + \rho\, x_{t-1} + \Sigma^{k}_{i=1}\, \delta_i\, \Delta\, x_{t-i} + \nu_t \tag{12}$$

Finally, Maddala and Kim (1998) note that the size and power properties of the test are sensitive to the number of lagged terms (k). For example, including too few lags may have a substantial effect on the "size of the test" (Perron 1989). In the literature, several guidelines have been suggested for the choice of k. I follow Perron (1989) and adopt a fairly liberal procedure: the value of k is equal to k* if the t statistic on δ_i is greater than 1.60 in absolute value and the t statistic on δ_l for $l>k^*$ is less than 1.60. "This liberal procedure is justified in the sense that including too many extra regressors of lagged first-differences does not affect the size of the test but only decreases its power" (Perron 1989).

3.1.4. Empirical Implementation

3.1.4.1. Nelson and Plosser (1982)

The publication of the paper by Nelson and Plosser (1982) is a hallmark in the application of unit roots analysis to time series. They found that they could not reject the null of (an auto-regressive) unit root in 13 (out of 14) US macroeconomic time series, in some cases spanning over 100 years. The existence of a unit root was interpreted as having important implications for the theory of business cycles and the persistence of the effect of real shocks to the economy. Though some economists argued that the evidence on unit roots is empirically ambiguous and also irrelevant to the question of the persistence of the effect of real shocks, the literature on unit roots keeps proliferating (Maddala and Kim 1998).

3.1.4.2. Russian Fertility Data

Table 3.1 in the main text shows the results for the estimated regression (12) on Russian total and age-adjusted fertility time-series. As a reminder, I tested the following null hypothesis: $\rho = 1$ and $\gamma = \kappa = 0$ against the alternative assumption of stationary fluctuations around a deterministic trend function, $\rho < 1$ and $\gamma \neq \kappa \neq 0$. The structural break year T_B is 1989.

Table 3.1.1

Summary Results of the Unit Root Tests with Structural Break

Series *(with T_B = 1989)*	k	ρ	$t_{\rho=1}$
Total Fertility rate	1	0.726	-3.046
Age-adjusted Fertility rate			
< 20 years	1	0.178	-8.812(*)
20 to 24 years	1	0.515	-4.443(*)
24 to 29 years	1	0.765	-2.612
29 to 34 years	3	0.719	-2.975
34 to 39 years	3	0.757	-3.179
39 to 44 years	1	0.731	-3.388
< 20 to 49 years	1	0.828	-2.928

Sources: Goskomstat (1996), INED (1996, 1998), author's own computation
Note: Critical value is -3.82 at five percent significance level.

Table 3.1.1 summarizes the main results. For all series, it shows the lag length k and the t-statistic for $\rho = 1$. Using Perron (1989), the critical value for $t_{\rho=1}$ is –3.82, at a five percent significance level[76]. For all series, with the exception of the first two age–adjusted fertility series, the values of the t-statistic for the estimated ρ is smaller than the critical value. This means that I fail to reject the null hypothesis: almost all series are better represented by a stochastic trend model.

For the first two age-adjusted time-series, the null hypothesis can be rejected. However, the rejection of the null hypothesis of a unit root (conditional on the possibility of the underlying trend function at a known date) does *not* imply that these series are best represented by a deterministic breaking trend model.

3.1.5 Critical Evaluation of the Testing Strategy

The testing strategy used in this chapter is impeded by several limitations:

1. Testing against a specific class of alternative hypotheses. The relevant question in a modeling exercise is: how probable is one hypothesis relative to other competing hypotheses? The usual outcome of a hypothesis-testing exercise is, however, much more limited: a researcher either rejects or fails to reject a hypothesis, but cannot tell the probability that a hypothesis holds. More generally, "as a matter of general principle, a rejection of the null hypothesis does not imply acceptance of a particular alternative hypothesis" (Perron 1989). In my example, either of the following results can be obtained: (1) fails to reject the null hypothesis: the series is better modeled by a stochastic trend; (2) can reject the null hypothesis: the series does not follow a unit root. Unfortunately, in the latter case, one cannot conclude that the series is therefore best modeled by a deterministic breaking trend. In fact, the testing procedure does not allow me to conclude.

2. Using a deterministic (breaking) trend as null rather than the unit root as null. The objective is to test whether fertility series can be satisfactorily represented by a deterministic (breaking) trend model. In an ideal world, the

[76] Perron's critical values for the limiting distribution test depends on λ, the time of the break relative to the total sample size. Practically, λ is computed as the ratio of the pre-break sample to the total sample size. I obtained a value for $\lambda = 0.8$. I then picked up the critical value corresponding to the sample value of λ at the chosen significance level.

testing-procedure would test this model against the alternative of a stochastic trend (DSP). Unfortunately, econometric testing proceeds the other way around: it tests whether the series follows a stochastic trend (model 1), against the alternative of a deterministic (breaking) trend (model 2). The null hypothesis is: the process is stochastic (or unit root). At the present time, one cannot test the deterministic breaking trend as the null hypothesis.

3. Low power of unit root tests. Tests of unit roots should be 'powerful' to discriminate the null hypothesis against the alternative. It has however been well documented that unit root tests have low power, especially against trend-stationary alternatives. Koop (1992) argues that: "even sophisticated traditional unit root tests are badly flawed, and at best should be used with extreme caution.". To increase the power of those tests, Maddala and Kim (1998) recently suggested increasing the number of observations, the frequency of observations and/or use panel data.

Appendix 3.2

Testing the Non-Stationarity of Russian Fertility Data

The fact that the time series is non-stationary is often self-evident from a plot of the series. Determining the actual form of non-stationarity is however not easy from just a visual inspection: an examination of the sample auto-correlation function (SACF) for various differences may be required. The SACF tells us how much correlation there is (and by implication how much interdependency there is) between neighbouring data points in the series[77].

I define the sample auto-correlation with lag *k* (r_k) as:

$$r_k = \text{cov}\,(y_t, y_{t+k}) / \sigma_{yt}\,\sigma_{yt+k}$$

To characterize the behaviour of the non-stationary series, I use Monte-Carlo simulations. Typically, a non-stationary (random walk) process is consistent with the following features:

- SACF of actual data: High SACF in the level at lag 1 and slow decay with increasing lags.
- SACF of the first differences: The SACF is expected to be positive and significant at lag 1, but not at longer lags.

Tables 3.2.1 and 3.2.2 show the sample auto-correlation function with increasing lags for actual and first-difference Russian fertility data, respectively. Both tables show consistent results: almost all fertility series (with the exception of the first two age-adjusted fertility series) exhibit a non-stationary behaviour over time. Indeed, the SACF of actual fertility data is high in the first lag and is slowly decaying; the SACF of the first difference is still significant at longer lags[78].

[77] For an introduction on auto-correlation function, see Pindyck and Rubinfeld (1991), Chap 15.
[78] The latter results are arguably less significant.

Table 3.2.1

Sample Autocorrelation of the Natural Logs of Annual Fertility data (*)

Series	r_1	r_2	r_3	r_4	r_5	r_6
Total fertility rate	0.785	0.566	0.316	0.113	-0.029	-0.122
Age-adjusted Fertility rate						
< 20 years	0.959	0.890	0.800	0.705	0.608	0.512
20 to 24 years	0.792	0.549	0.255	0.026	-0.128	-0.216
24 to 29 years	0.829	0.625	0.391	0.187	0.034	-0.071
29 to 34 years	0.845	0.663	0.471	0.314	0.192	0.102
34 to 39 years	0.848	0.684	0.591	0.382	0.270	0.184
39 to 45 years	0.870	0.739	0.615	0.512	0.423	0.352
< 20 to 49 years	0.799	0.568	0.308	0.087	-0.081	-0.202

(*) The sample size is 36 and r_i is the ith order auto-correlation coefficient.

Sources: Goskomstat (1996), INED (1996, 1998) and author's own computation

Table 3.2.2

Sample Autocorrelation of the First Difference of the Natural Logs of Annual Fertility data (*)

Series	r_1	r_2	r_3	r_4	r_5	r_6
Total fertility rate	0.603	0.375	0.275	0.118	-0.050	-0.169
Age-adjusted Fertility rate						
< 20 years	0.348	-0.034	-0.137	-0.017	0.031	-0.032
20 to 24 years	0.642	0.459	0.300	0.135	0.002	-0.098
24 to 29 years	0.646	0.307	0.187	0.018	-0.153	-0.287
29 to 34 years	0.659	0.250	0.096	0.019	-0.139	-0.290
34 to 39 years	0.625	0.241	0.067	-0.004	-0.148	-0.370
39 to 45 years	0.527	0.094	-0.151	-0.163	-0.269	-0.415
< 20 to 49 years	0.761	0.576	0.465	0.326	0.101	-0.073

(*) The sample size is 36 and r_i is the ith order auto-correlation coefficient.

Sources: Goskomstat (1996), INED (1996, 1998) and author's own computation

IV. The Effect of Shifts in Income and Uncertainty on Fertility:

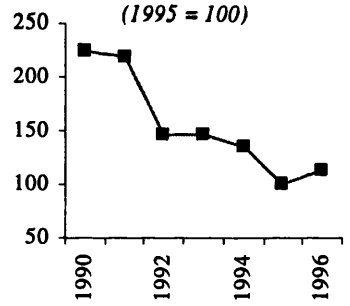
Evidence from Russian Regional Data

"C'est la facilité de parler, et l'impuissance d'examiner, qui ont fait dire que plus les sujets étaient pauvres, plus les familles étaient nombreuses"
Montesquieu, 1871

Introduction

This chapter assesses the impact of the fall in aggregate income on the fertility rate, using Russian regional data for the 1990-95 period. The deterioration in material wellbeing, as measured by income, is conventionally regarded as the primary factor behind the fall in the fertility rate. In particular, the rapid fertility decline is viewed as the short-term (negative) freeze reaction to the economic crisis. My findings challenge this simple economic explanation of the fertility decline for Russia, and show a much more complex phenomenon: the fertility rate fell in response to (proxies for) both lower income and increased uncertainty.

Fig. 4.1: Real Monthly Wage, Russia, 1990-96
(1995 = 100)



Source: Russian Economic Trends, 1997

The conventional wisdom, that 'the income fall caused the fertility crisis', stems from the view that the process of economic and political transition led to large economic costs to the population, of which the deterioration in income is the most salient indicator. For example, figure 4.1 shows that, in Russia, monthly real wages fell by more than half between 1990 and 1996 (RET 1997)[79]. The coping mechanism to this new budget constraint was a reduction in the consumption of all goods, including the number of children.

The connection between income and fertility is however not as simple as it looks. First, the connection has weak micro-economic foundations. The economic theory of reproductive behaviour suggests that a change in income can either increase or decrease fertility (Becker 1981).

[79] It is however important to note that there was a fundamental break in the economic situation in 1992, and that the pre and post 1992 data about the retail market are non-comparable. I am grateful to Michael Ellman for this point.

Second, empirical studies on the relationship between changes in fertility and income have hitherto given mixed results. Showing that such a relationship exists, in a cross section, would be in itself a significant step. Finally, the nature of the income concerned has to be further defined. Are we talking about individual or aggregate income? Is current income the only factor that matters? Does future income matter as well? In particular, can the uncertainty surrounding future income explain the fertility change?

The outcome of this chapter is threefold: first, the dominant economic hypothesis on the rapid fertility decline is tested empirically. Second, the simple economic explanation of the fertility decline is enriched by adding a second explanatory variable, 'people's perception of uncertainty'. Finally, cross-regional data for Russia is used for empirical testing.

As I will show below, this chapter uses regional data of Russia for the 1990-95 period. The (change in the) volume of industrial production is used to proxy (the change in) income (Goskomstat 1996b). The unemployment rate in 1994 from the Labour Force Survey is used to proxy 'people's perception of uncertainty' (Goskomstat 1996a). The dependent variable is the change in the fertility rate (i.e. total, urban and rural) (INED 1996, 1998).

I find that (proxies for) income and uncertainty can explain regional differences in the fertility decline. In particular, regions with the largest fall in the fertility rate experienced the largest fall in (the proxy for) income and higher uncertainty. This conclusion holds, in a cross-section, for changes in the total and urban fertility rates, but not in the rural fertility rate.

The structure of the chapter is as follows: section 1 investigates the regional dimension of the rapid fertility decline in Russia. Section 2 examines theories and evidence on the effect of income on the fertility rate. Section 3 considers the question of empirical measurement of income. Section 4 uses standard regression analysis to test the extent to which income and uncertainty explain regional differences in the rate of fertility decline.

1. The Regional Dimension to the Fertility Decline in Russia

This section examines whether there are regional disparities in the rate of fertility decline. Using Russian fertility data (total, rural and urban fertility rate), I show that regions differ in the fertility levels and rate of decline in the 1980s, but there is a striking uniformity in the rate of decline over the 1990-95 period.

1.1. Preliminary Observations

That there are regional differences behind national measures of the total fertility rate (TFR) is straightforward. Some regions may have a TFR quite above the national TFR, other regions quite below, and the distribution of regions on the fertility scale may vary a great deal. Knowing the national change in the fertility rate becomes secondary, once regional disparities are put in evidence.

The study of the regional dimension of the fertility decline is important for two reasons: first, references to the Central and East European fertility decline are based on national (aggregated) fertility data. Despite regional data recently made available in some countries, there has been little attention devoted to the regions, and the regional dimension of the fertility decline.

Second, for Western European countries, the few regional fertility studies that are available are largely descriptive. Most studies observe regional disparities in the fertility rate, while failing to explaining their causes. For example, it is generally claimed that the Italian TFR decline hides wide regional disparities. In particular, there is a geographical difference between the north and the south of Italy. For example, the deviation from the national average (TFR_{87} = 1.3) between the northern regions (Center North TFR_{87} = 1.09) and the southern regions (Mezzorgiorno TFR_{87} = 1.65) is quite large (Golini 1991). Up to now, demographic studies have largely failed to explain these regional disparities.

Using regional fertility data for Russia (1990-95), the following preliminary observations can be made:

1. The fertility rate collapsed in all the regions of Russia. It is therefore the *rate* of change (and the initial level), rather than the decline *per se* that characterizes each region.

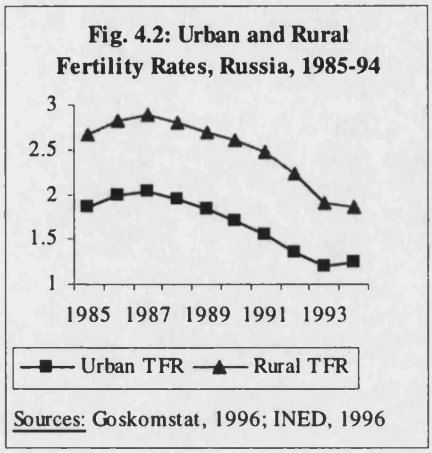


Fig. 4.2: Urban and Rural Fertility Rates, Russia, 1985-94

Sources: Goskomstat, 1996; INED, 1996

2. There are regional differences between the urban and the rural fertility rates. As shown in Figure 4.2, both fertility rates collapsed. The urban fertility rate appears, however, to have fallen slightly more: this suggests that both rates should be investigated separately.

3. The TFR can hide differences in the rate of urbanization. For example, the TFR may reflect the fertility behaviour of a region predominantly rural, while decisions in urban areas may be considerably different. In what follows, I will have to control for this effect.

1.2. Regional Diversity in Urban Fertility Rates: Characterization

I order 66 regions (or territorial administrative units) of Russia into five subgroups of regions. This grouping is consistent with the typology proposed by Zakharov and Ivanova (1996). Their typology is based on a study of cultural and economic (modernization) differences among regions. I use this typology to ease the presentation of this large sample of regions[80].

I investigate separately the urban fertility rate from the rural fertility rate[81]. For each subgroup of regions, I compute aggregate (average) indicators of urban fertility. The following indicators are considered: 1) the urban fertility rate in 1990, 2) the urban fertility rate in 1995, 3) the (average annual) change in the urban fertility rate over the

[80] Appendix 4.1 shows the typology used for the urban fertility rate.
[81] Appendix 4.2 examines the regional rural fertility rates.

1990-95 period, 4) the change in the urban fertility rate between 1990 and 1995 and 5) the change in the crude birth rate between 1980 and 1988[82].

From table 4.1, there are three observations:

1. For each subgroup of regions, there are distinct urban fertility levels in 1990 and 1995.
2. Despite that, there is a striking uniformity in the rate of urban fertility decline in the first half of the 1990s. Across all groups of regions, the urban fertility rate fell, on average, by 32 percent between 1990 and 1995--the equivalent of an annual fall of 8 percent.
3. Provided that the change in the crude birth rate can be used to proxy for what happened to the urban fertility rate in the 1980s, table 4.1 shows that the fertility decline accelerated across all the regions in the 1990s. For example, in the fifth subgroup of regions, fertility fell by 3.8 percent between 1980 and 1988, while it fell by ten times more between 1990 and 1995.

Table 4.1: Russian Urban Fertility Rate by Group of Regions, 1980-95

	Urban Fertility rate				Crude Birth Rate
	1990	1995	Avg annual chg 1990-95 *(in percent)*	Chg of 1995 over 1990 *(in percent)*	Chg of 1988 over 1980 *(in percent)*
Group 1	2.411	1.643	-7.49	-32.15	0.82
Group 2	1.932	1.319	-7.40	-31.81	-2.07
Group 3	1.846	1.213	-8.05	-34.24	-2.16
Group 4	1.721	1.126	-8.12	-34.43	-4.80
Group 5	1.644	1.118	-7.41	-31.84	-3.88

Note: Each indicator is an average of regions in the group (appendix 4.1).
Sources: Goskomstat (1996), INED (1996, 1998) and author's own calculation

[82] Because the regional urban fertility rate is not available in the 1980s, I used the crude birth rate--both series (crude birth rate and urban fertility rate) are highly correlated: the coefficient of correlation is 0.946 in 1990. I also selected the 1980-88 period, because the 1989 crude birth rate data were not available.

2. The Impact of Income on Fertility: Theory and Evidence

This section briefly reviews theories and evidence on the effect of a change in income on fertility. The objective is to find out whether we can support the view that an income fall can lead to a rapid fertility decline. I begin by defining what is meant by 'income'. I then show that the predictions from the economic theory of reproductive behaviour are ambiguous and the evidence from empirical testing is mixed. Finally, I draw the implications for empirical testing.

2.1. The Definition of Income

The term 'income' requires immediate attention. There are at least two related, but different concepts of income: (1) the income of the individual earner or the individual family. This is the appropriate concept when one focuses on the microeconomic analysis of individual fertility decisions. (2) Average national income (or per capita income). This concept is more aggregate and more general than individual income. It refers to the economic conditions prevailing in a given country at a given time.

What may be said about the effects of changes in average and individual incomes is not always the same:

1. Economic conditions and the level of average national income obviously affect incomes of individuals. But aggregate conditions have economic effects other than the effects of individual incomes that may affect fertility decisions. Examples include changes in employment opportunities and in education.

2. Individual incomes can change with no change in average income. Examples include change in the income distribution and transfer payments to families with children.

2.2. The Theory: Ambiguous Predictions

The economic theory of reproductive behaviour has usually concentrated on the microeconomic family decision-making aspects. The theory has gone through several stages that are not reviewed here. In Chapter II, I explored the most important theories. I briefly remind the reader of the central contributions of Becker and Mincer.

- Becker (1960) formalized the notion of the demand for children as 'consumption' goods. He distinguished between two dimensions of a family's reproductive decisions: the quantity (number) of children a family 'purchases' and the 'quality' (e.g. education) per child it decides to purchase.

- Mincer (1963) focused on the woman's work decision, emphasizing that children represent an opportunity cost in foregone wage because additional children reduce the capacity of women to work in the market—the substitution effect.

As a reminder of Chapter II, the key predictions of Becker's economic theory of reproductive behaviour can be described as follows:

- Central to Becker's argument is that economic analysis should proceed on the assumption that tastes and values are unchanged by income. In that case, an increase in income should be translated into a *rise* in fertility. I refer later to a 'pure income effect'—the partial effect of income, holding personal characteristics constant.

- However, in some circumstances, an increase in income might be translated into a *decrease* in fertility. The idea is that the household changes the purchase of other goods whose enjoyment requires time and hence competes with the time the family might spend with the child.

In sum, the economic theory of reproductive behaviour predicts that income-produced forces act on fertility in opposite directions. "It is a fact that pure economic theory by itself cannot predict whether the effect of an additional individual (and national) income will be on balance to lower or higher fertility" (Simon 1974).

Two assumptions underlie the discussion on the effect of income (and economic crisis) on fertility. First, reproductive decisions are based on a rational evaluation of the benefits and costs involved in having children. The rationalization of the reproductive decision-making process became dominant in the field with Becker's work. Chapter V will however show that 'rationality' (in the economic sense) can be challenged in the presence of broad uncertainty.

Second, individuals have to make a choice about reproduction. The economic theory states that households will consciously *choose* to have fewer children, whenever they have less income (whenever their tastes are constant). Economists prefer to believe that individuals have control over their lives and that everything is a matter of choice. The extent to which this is always true is unclear. One may imagine, for example, that the deterioration in income becomes so strong that individuals are *forced* to have fewer children. In that case, poverty dictates the course of life and there is no choice to make[83].

2.3. Empirical Evidence: Mixed Results

The absence of a solid theory of reproductive behaviour has not discouraged active empirical research on the effect of income on fertility[84]. The idea that income or more generally, economic conditions, matter in family decisions has been documented in numerous surveys. Simon (1974) reports however, on the complexity of the issues at stake. "Despite the fact that income (in more developed countries) is more than sufficient to provide means of subsistence for many children that the average family chooses to have, people *say* in responses to questions of various sorts that their income constrains their family size". This observation suggests that standards of living and economic conditions matter in reproductive decisions, but in an intricate way[85].

2.3.1. The 'Pure' Income Effect

Evidence on the partial effect of income, holding personal characteristics constant, is twofold:

1. Time-series data over business cycles. In the short-run—during which parents' tastes can be considered as fixed, aggregate time-series data show that change in personal income and unemployment have strong same-direction effect on fluctuations in fertility (Simon 1974).

2. Cross-sectional data. Comparisons of fertility rates among different income groups at a single point in time tell relatively less. One problem is that the

[83] The discussion brings us back to the fundamental difference between the economic and the demographic paradigms (Chapter II). As I will argue in Chapter VI, this distinction has major policy implications.
[84] I omit any considerations of the influence running *from* fertility and population growth to economic conditions.
[85] It also suggests that there may be a difference between current and perceived income. I return to this point in chapter V.

income refers only to a period much shorter than the individual's lifetime, usually a year. Reproductive decisions may however be affected by income received in earlier years, and perhaps the income stream the couple expects to receive in future years[86].

2.3.2. The Long Term Income Effect

As noted above, the partial effect of income is to raise fertility by increasing the family's power to afford children. "But in the long run a rise in income has many other sorts of effects upon people, some of which then influence fertility either upward *or* downward. Some of these effects are strong and unambiguous, while others are subtle and complicated" (Simon 1974). It is these other effects that come into the longer run analysis.

For example, it is generally believed that increased average income gives women access to education; this, in turn, lowers fertility. Income increases may also have many other effects upon people's actual and perceived economic situations that may affect fertility in complicated ways. "For example, children are not homogenous, and people have at least some discretion about how much they will choose to spend on an additional child, e.g. whether or not to pay for his education through graduate school. This discretion complicates the decision about whether to have children, because a couple can pick different combinations of numbers of children and expenditures on them... It is, therefore, theoretically possible that a rise in income will have the direct effect of *lowering* the number of children people 'purchase'." (Simon 1974).

"All discussion of the total effect of income on fertility must confront this empirical fact: among the countries...with hallmarks of being modern and developed, there is a considerable spread of fertility rates that is *not* systematically associated with their income levels. Therefore, either there are several conflicting partial effects of income on fertility whose composite effect differs from place to place, or factors not systematically associated with income are more important than income in determining a nation's average fertility level..."(Simon 1974).

[86] For a discussion on the consistency between time-series and cross-sectional fertility data, see Simon (1974).

2.4. Implications for Empirical Testing

Previous empirical studies suggest that conclusive findings can be obtained if the period of investigation is sufficiently short. During that time, 'tastes' for children (and their prices) are expected to be fixed, and there is a possibility to find a 'pure income effect'. Empirical testing would come down to verify whether there is a *positive* relationship between a change in the fertility rate and a change in income.

In most circumstances, the choice of a short period of change is sufficient to neutralize the effect of 'tastes'. In the context of transition, this may, however, not be sufficient. In fact, Chapter III showed that there has probably been a change in 'tastes' in Russia, towards the end of the 1980s[87]. To minimize the problem, I chose to study the fertility change in the period *after* the structural break in the fertility trend, i.e. the 1990-95 period. During that time, 'tastes' are expected to be relatively stable and change gradually.

[87] More precisely, I showed a structural break in the fertility trend in 1989 and concluded for a change in the attitudes towards reproduction.

3. The Measurement of Income

In transition economies, income figures are largely unreliable. In Russia in particular, income figures suffer from a "problem of too much 'correction' " (Granville Shapiro and Dynnikova 1996). This section describes the problems related to the measurement of income in Russia and suggests some solutions—the use of a proxy and adequate period of investigation. I also define a proxy for 'people's perception of uncertainty'.

3.1. Which Income?

In an ideal world, I would test the effect of a change in *individual* income on fertility. Practically, individual income data is often unreliable and it may be easier to work with *aggregate* income data, or a proxy for general economic conditions.

For Granville *et al.* (1996), Russian *individual* income data are unreliable:

> "Income figures are adjusted so much that they lose all meaning. It is understood that Goskomstat needs to make estimates of informal activity, of changes from roubles to hard currency and *vice versa*, and of non-reported income. The problem with the income data is, first of all, a problem of too much 'correction' (viz. wages are understated, and non-wage income overstated). In addition, there are reports of other errors in basic concepts. As we have found such a high correlation between wages and income since 1994 (precisely when reported income began to be so much higher than reported wages), we remain doubtful that anything actual is being measured by the income data, beyond non-reported wages".

I now examine the extent to which *aggregate* income data can be used to proxy individual income positions. As argued in section 2.1, there are circumstances in which changes in *individual* income are not reflected in *aggregate* data. For example, aggregate data can falsely reflect individual income positions, whenever the income distribution changes over time.

In transition Europe where the income distribution changed considerably in the 1990s, aggregate income data may therefore not adequately reflect individual income positions. As an illustration of the change in income distribution in Russia, I use the Gini

coefficient, the most frequently used measure of income inequality: the Gini coefficient rose from 0.26 in 1991 to 0.40 in 1994 (Goskomstat 1996). "The top quintile in 1993 received fully 20 percentage points more of total income than the top quintile in 1988, mainly because of an explosive increase in the relative share of the very richest people and also because of increasing wage dispersion" (World Bank 1996).

In Russia, aggregate income data may however be used to proxy individual income given that both indicators actually fell. One the one hand, the fall in GNP, a measure of aggregate income[88], indicates that on *average,* people became worse off during the transition. On the other hand, the presence of rising income inequality suggests that more people may have lost from the transition than gained[89]. At worse, using aggregate income data will under-estimate the fall in individual income of those at the bottom of the income-scale.

3.2. A Proxy for Regional Income

I am primarily interested in obtaining a measure that, although aggregate, would reflect the income position of individuals. Ideally, this measure would be close to the National Income, Y of the National Accounts and available for each region. Unfortunately, such a measure is not available.

To proxy for income, the total value of output (GNP) could be used—both measures are identical in the national accounting sense. There are, however, a number of problems in using GNP:

1. National unreliability. GNP is an unreliable indicator of activity in Russia. It suffers from under-reporting of private and services sectors activities. Moreover, some goods that cannot be sold on the market are considered as part of the total output. The direction of the bias is in itself a matter of debate (Gavrilenkov and Koen 1994).

2. Regional unreliability. Although some measures of regional "GNP" were recently made available, they represent rough approximations of the real activity in the regions: these measures suffer from under- and over-reporting problems as well.

[88] Provided that GNP is a reliable measure of aggregate income in Russia.

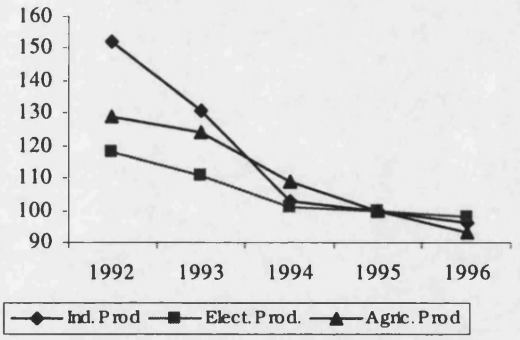
3. Nominal measure. Total output is generally published in nominal terms and includes the computation of an index of prices. In a country that underwent hyper-inflation like Russia, nominal and real measures differ a great deal, the selection of a base-year is subjective, and the computation of a price index complex. These problems can be solved, but at the expense of a large number of assumptions.

To proxy for regional output, I use the volume of industrial production in the region (1990 = base-year). This represents a measure of output in real terms and is available for each region.

I am interested not so much in the absolute level of industrial production, as by its variation over time. The year-to-year change in the industrial production is used to neutralize the effects of *systematic* under-reporting problems. Using the (change in the volume of) industry production to proxy (change in) income has been used in a number of empirical studies: it can be roughly justified in the specific context of Russia (Gavrilenkov and Koen 1994).

To illustrate the relevance of this proxy (at the national level), figure 4.3 plots the index of production of various goods over time. As shown, the *change over time* of industrial production closely paralleled the *change over time* of two alternative production activities[90]: 1) electricity production[91], and 2) agricultural production. Thus, using the change in industrial production over time is as a relatively good proxy for the change in the production (and thus income) of other sectors of the economy.

Fig. 4.3: Industrial, Electricity and Agricultural Productions, Russia, 1992-96 *(1995 = 100)*



Source: Russian Economic Trends, 1997.

[89] The question of winners and losers of the transition is however unresolved. The concept was recently explored in the Russian context by Elizabeth Brainerd, 1998.
[90] It could however be argued that this is not really the case in 1992-94.
[91] In fact, the alternative proxy for income is electricity consumption (Ellman 1999). Here, I assume that production equals consumption.

In using the industrial production to proxy for income, there is, however, a risk to over-estimate the fall in actual income. Indeed, while production in most sectors of activity fell, it actually increased in the services sector. As noted above, the main problem is that there is no measure available of what happened to the services sector in the first half of the 1990s. Thus, I will have to make the (simplifying) assumption that this may be a shortcoming for the metropolitan regions, Moscow and St Petersburg. In those two regions, there is evidence that the services sector rapidly expanded. I will control for this effect by defining a dummy (METROP). For the other regions, I will have to keep in mind that the proxy used for income change may over-estimate the actual fall in income.

3.3. Period under Investigation

Section 1 argued that a short period of change was desirable to keep 'tastes' constant. To control for this effect, I chose the period that followed the structural break in the fertility trend, i.e. 1990-95. Moreover, I compute the average year-to-year change, rather than the total change between 1990 and 1995. This averaging procedure provides a smoother measure of the variation in output.

3.4. Regions under Investigation

From the regional data that I collected, I excluded the 9 regions of the North Caucasus 'rayon' and 'autonomous okrugs': for those regions, data series were either incomplete, or suffered from reliability problems[92] (Vandycke 1996). Taking into account other regions with missing data, the final data set consists of 66 regions of Russia.

I define a subgroup of 12 regions that is characterized by an 'exceptionally large' fall in industrial production. This subgroup encompasses regions that experienced an (average annual) fall in industrial production of above 17 percent. This subgroup of regions is expected to feature a distinct and exceptionally large fertility decline.

To capture this pattern, I define a dummy variable, DUM2. Technically, DUM2 is defined as the product of the (change in the volume of) industrial production and DUM1, where DUM1 takes the value of 1 for regions where the change in industrial production was larger than 17 percent. As shown in Chapter III, the dummy is used to

[92] These regions happened to be predominantly Muslim, with specific fertility patterns.

capture the distinct slope in the regression line for this subgroup of regions. Specifically, the regression line has the following form:

$$E(\Delta TFR_{90\text{-}95}) = \beta_0 + \beta_1 \,.\, \Delta IP_{90\text{-}95} + \beta_2 .\, (\Delta IP_{90\text{-}95} \,.\, DUM1)$$

For all the regions, except the 12, DUM1 = 0 $\Rightarrow E(\Delta TFR_{90\text{-}95}) = \beta_0 + \beta_1 \,.\, \Delta IP_{90\text{-}95}$

For the 12 regions: $\Rightarrow E(\Delta TFR_{90\text{-}95}) = \beta_0 + (\beta_1 + \beta_2)\, \Delta IP_{90\text{-}95}$

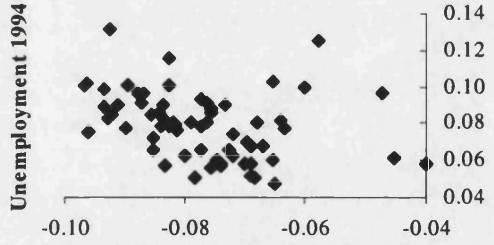
3.5. A Proxy for 'People's Perception of Uncertainty'

As I will show in Chapter V, broad uncertainty is endemic to transition Europe. As such, uncertainty is likely to have had an impact on reproductive decisions (Ellman 1997). In this part, I test empirically whether (a proxy for) uncertainty is a significant explanatory factor of the Russian regional fertility decline.

I assume that uncertainty affects the *perception* of current and future job opportunities, future income, and the general economic climate. I consider that its effect is to raise 'the lack of confidence in tomorrow'.

To proxy for 'people's perception of uncertainty', I use the unemployment rate[93] in 1994 from the Labour Force Survey (Goskomstat 1996a). In Russia, the unemployment rate rose from virtually a zero-level by the end of the 1980s to about 8.4 percent in 1995 (UNECE 1998). Under those circumstances, it is reasonable to expect that uncertainty about job prospects and future income increased; this, in turn, affected the fertility rate. As show in figure 4.4, preliminary evidence suggests that the unemployment rate is related to the (change in) total fertility rate in 66 regions of Russia.

Fig. 4.4: Total Fertility rate and Unemployment Rate, Russia, 1990-95



Sources: Goskomstat, 1996 (for LFS, 1994); INED, 1996, 1998.

[93] The LFS data is expected to provide a better picture of the unemployment problem (and uncertainty regarding present and future income), than the official unemployment rate (a measure of the number of people claiming unemployment benefits). It is however far from being a perfect proxy for 'people's perception of uncertainty'.

The presence of unemployment rates similar to those in Western Europe suggests that the level of uncertainty is identical in Western Europe, as in Central and Eastern Europe. This is clearly not the case: the uncertainty surrounding job opportunities and the future is much larger in Central and Eastern Europe[94]. This observation already indicates that the unemployment rate is likely to be an imperfect measure of uncertainty in transition economies.

[94] Chapter V explores the effect of uncertainty on the reproductive decision-making process.

4. Specification and Empirical Findings

4.1. Specification

This section explores the relationship between the (average annual) change in the volume of industrial production (a proxy for income) and the (average annual) change in the fertility rate. The average annual changes in both variables are calculated over the 1990-95 period[95]. I define a dummy, DUM2, to capture regions that are characterized by a 'large' fall in industrial production (i.e. an average annual fall in industrial production above 17 percent). The data set covers 66 regions of Russia.

The unemployment rate in 1994 from the Labour Force Survey is used to proxy for 'people's perception of uncertainty' (Goskomstat 1996a). The control for inter-regional disparities between rural and urban areas is done with a 'modernization' variable, URBAN95—defined as the share of urban population in the total population in 1995 (Goskomstat 1996). The Regions of Moscow and St Petersburg are isolated into a dummy (METROP).

The dependent variable is the (average annual) change in the regional fertility rate, i.e. total, urban and rural fertility rates (Goskomstat, 1996 and INED 1996, 1998).

4.2. Econometric Results

The results are reported below, with the t-statistic in parenthesis[96]. Before I examine each set of results, let me start with a general remark. In the first two regressions, the most important explanatory variable $\Delta IP_{90\text{-}95}$ (and DUM2) is significant at a 10 percent level, but not at 5 percent. On conventional econometric grounds, this means that $\Delta IP_{90\text{-}95}$ is only slightly significant (and could probably be rejected as an explanatory variable). However, in the particular case that is examined here, the significance of the result is probably the best it can possibly be--given the use of proxies, very aggregate data, and measurement problems, and can be retained. It indicates that the approach used in this chapter is only a first step in testing the economic explanation of the fertility decline and that further investigation is required in this direction.

[95] Appendix 4.3 gives the regional data.
[96] In all regressions, the value of the Durbin-Watson statistic indicates that serial correlation is unlikely to be present in the estimated residuals.

The first regression shows a pattern with regard to the total fertility rate (TFR): regions with the largest change in the *total* fertility rate suffered from the largest change in (the proxy for) income. The positive relationship between change in the total fertility rate and change in (proxy for) income holds not only for the large group of regions (54 observations), but for the 12 regions as well. For this latter group, the intercept of $\Delta IP_{90\text{-}95}$ is positive—it is the sum of the coefficients of $\Delta IP_{90\text{-}95}$ and DUM2.

I find that (the proxy for) 'people's perception of uncertainty', $UNEMP_{94}$ is significant. This is a striking result. It shows that it is the combination, and not the unique effect of income with uncertainty, that can explain regional disparities in the rate of change of the total fertility rate[97].

As expected, the metropolitan regions (Moscow and St Petersburg) follow a specific pattern, and the control for urban-rural inter-regional differences is significant—regions with a significantly higher share of population in urban areas had, holding all other variables constant, a significantly larger fall in TFR.

$$\Delta TFR_{90\text{-}95} = \underset{(-2.83)}{-0.035} + \underset{(1.86)}{0.093}\,\Delta IP_{90\text{-}95} - \underset{(-1.48)}{0.038}DUM2 - \underset{(-2.07)}{0.164}\,UNEMP_{94} + \underset{(3.22)}{0.029}\,METROP - \underset{(-1.99)}{0.027}\,URBAN95 \quad (*)\,(1)$$

R-squared = 0.249 DW = 2.181 66 observations

(*) all coefficients are significant at a 5 percent significance level, except $\Delta IP_{90\text{-}95}$ and DUM2.

The second regression shows the relationship between the change in the *urban* fertility rate and changes in (the proxies for) income and uncertainty. Compared to the first regression, I explore here the determinants of the change in the urban fertility rate (and ignore the urban-rural variable). The key finding is that a similar relationship holds for the urban fertility rate as for the total fertility rate: in the regional cross-section, the decline in the urban fertility rate is significantly related to the fall in income and increased uncertainty. In particular, regions with the largest fall in the urban fertility rate experienced the largest fall in income and higher uncertainty.

[97] Appendix 4.4 shows that there is no multi-collinerarity in this multiple regression model.

$$\Delta TFRurban_{90\text{-}95} = -0.057 + 0.071\ \Delta IP_{90\text{-}95} - 0.039 DUM2 - 0.161\ UNEMP_{94} + 0.021\ METROP \quad (2)$$
(-8.74) (1.61) (-1.69) (-2.31) (3.02) (*)

R-squared = 0.228 DW = 1.976 66 observations

(*) all coefficients are significant at a 5 percent level, except $\Delta IP_{90\text{-}95}$ and DUM2.

The third regression shows the relationship between the change in the *rural* fertility rate and the changes in (the proxies for) income and uncertainty. I find that (the proxies for) uncertainty and income for the subgroup of regions fail to explain regional differences in the rural fertility rate change: both the proxy for uncertainty, $UNEMP_{94}$ and the dummy for the subgroup of regions, DUM2 are insignificant. In a fourth regression, I dropped both variables.

$$\Delta TFRrural_{90\text{-}95} = -0.051 + 0.244\ \Delta IP_{90\text{-}95} - 0.061 DUM2 + 0.041\ UNEMP_{94} + 0.086\ METROP \quad (3)$$
(-2.96) (2.15) (-1.04) (0.22) (4.71) (*)

R-squared = 0.283 DW = 2.07 66 observations

(*) all coefficients are significant at a 5 percent significance level, except $UNEMP_{94}$ *and DUM2.*

The fourth regression shows a significant relationship between the change in the rural fertility rate and the change in (the proxy for) income. Does this finding imply that 'people's perception of uncertainty' played no role in the rate of fertility decline in rural areas?

$$\Delta TFRrural_{90\text{-}95} = -0.055 + 0.158\ \Delta IP_{90\text{-}95} + 0.081\ METROP \quad (4)$$
(-5.273) (2.032) (4.619) (*)

R-squared = 0.270 DW = 2.05 66 observations

(*) all coefficients are significant at a 5 percent significance level.

One reason to doubt is that both the urban and rural fertility rates fell in parallel. As shown in figure 4.2 above, rural fertility decline closely paralleled urban fertility decline. Moreover, the declines in both fertility rates were simultaneous in time. These observations suggest that both fertility rates responded to identical factors; there is no reason to believe that uncertainty affected the fertility rate in urban areas, and not in rural areas.

It may, however, be possible that rural areas were less responsive to factors of change than urban areas. Rural areas may be more 'conservative', and therefore less inclined to changes. This may also mean that people living in rural areas may have been less anxious about changes. They believed that the *status quo* would be maintained, and did not experience increased uncertainty from transition.

Another explanation may be that uncertainty is more bounded for rural populations[98]. While in urban areas, people with no job have no income and hence starve, people in rural areas with no job can grow their own food (and do not face the uncertainty of death). Thus, for rural people, there is a lower bound for income that is above zero.

A much more simple explanation would be that the proxy used for 'people's perception of uncertainty', the unemployment rate does not adequately reflect rural people's perceptions of the future.

[98] I am grateful to Nick Barr for this explanation.

Conclusions

This paper has presented some preliminary findings on the impact of the deterioration in income on fertility. It used standard econometric regression techniques to test the extent to which the economic crisis has influenced downturns in fertility, using Russian regional data. In a cross-section, it tested two hypotheses: first, the relationship between income and fertility; and second, the impact of uncertainty on fertility.

I began to explore the regional dimension of rapid fertility decline in Russia. I found a striking uniformity in the rate of fertility decline across regions. In particular, the urban fertility rate fell by about 30 percent across the regions of Russia between 1990 and 1995--the equivalent of an average annual fall of 8 percent.

I then examined theory and evidence on a possible relationship between income and fertility. I showed that the predictions of the economic theory of reproductive behaviour are ambiguous and the evidence from empirical testing is mixed.

To test the hypotheses of this chapter, I used two proxies: the (average annual change in) the volume of industrial production to proxy for the (average annual change in) income; and the unemployment rate in 1994 of the Labour Force Survey to proxy for 'people's perception of uncertainty'. The period of investigation is 1990-95. The dependent variables were the (average annual change in) the fertility rates (total, urban and rural fertility rates). I applied standard OLS regression technique.

I found that the fertility decline is closely connected to (proxies for) income and uncertainty. In particular, regions with the largest fall in the total (and urban) fertility rate experienced the largest fall in (the proxy for) income and higher uncertainty.

This paper gave preliminary insight into the causes of the rapid fertility decline in Russia: first, it showed a relationship between the change in income and the change in the fertility rate. In a cross-section, it showed a positive relationship between both variables. Second, it challenged the simple economic explanation of the fertility decline, in which the deterioration in income explains the entire story. It showed that 'people's perception of uncertainty' can increase the explanatory power of the regression model.

Appendix 4.1

Russian Urban Fertility Rate by Group of Regions, 1980-95

		TFR 1990	TFR 1995	Chg TFR 1990-95	Avg an. chg TFR 1990-95	chg birth rate 1980-88
Group 1		**2.411**	**1.643**	**-0.322**	**-0.075**	**0.008**
	56 Tuva	2.669	1.938	-0.274	-0.062	0.125
	55 Buryatia	2.184	1.398	-0.360	-0.085	-0.025
	33 Kamykia	2.379	1.592	-0.331	-0.077	-0.076
Group 2		**1.932**	**1.319**	**-0.318**	**-0.074**	**-0.021**
	61 Yakutia	2.098	1.572	-0.251	-0.056	0.097
	59 Irkutsk oblast	2.051	1.328	-0.353	-0.083	-0.037
	54 Tyumen oblast	1.873	1.332	-0.289	-0.066	0.000
	60 Chita oblast	2.008	1.522	-0.242	-0.054	-0.095
	64 Amur oblast	1.930	1.275	-0.339	-0.080	-0.028
	3 Arkhangelsk	1.878	1.195	-0.364	-0.086	-0.084
	41 Bashkortstan	1.931	1.322	-0.315	-0.073	0.080
	67 Sakhalin	1.920	1.192	-0.379	-0.091	-0.024
	36 Vologda	1.785	1.201	-0.327	-0.076	-0.026
	50 Kemerovo	1.846	1.252	-0.322	-0.075	-0.090
Group 3		**1.846**	**1.213**	**-0.342**	**-0.081**	**-0.022**
	62 Primorski krai	1.857	1.192	-0.358	-0.085	-0.077
	2 Komi	1.775	1.194	-0.327	-0.076	-0.105
	1 Karelia	1.889	1.175	-0.378	-0.091	-0.018
	42 Udmurtia	1.891	1.157	-0.388	-0.094	-0.011
	34 Tatarstan	1.949	1.293	-0.337	-0.079	0.121
	10 Bryansk	1.861	1.284	-0.310	-0.072	-0.077
	43 Kurgan	1.889	1.177	-0.377	-0.090	-0.058
	28 Belgorod	1.798	1.239	-0.311	-0.072	-0.039
	52 Omsk	1.765	1.203	-0.318	-0.074	-0.056
	45 Perm	1.851	1.195	-0.354	-0.084	0.026
	47 Chelyabinsk	1.853	1.210	-0.347	-0.082	-0.013
	4 Volgograd	1.865	1.203	-0.355	-0.084	-0.070
	26 Kirov	1.806	1.169	-0.353	-0.083	-0.065
	23 Mari El	1.924	1.211	-0.371	-0.088	0.011
	68 Kalingrad	1.763	1.179	-0.331	-0.077	0.007
	40 Ulyanovsk	1.856	1.196	-0.356	-0.084	0.094
	44 Orenburg	1.882	1.256	-0.333	-0.078	-0.052
	46 Sverdlovsk	1.737	1.183	-0.319	-0.074	-0.056
	35 Astrakhan	1.874	1.308	-0.302	-0.069	0.068
	58 Krasnoyarski krai	1.827	1.237	-0.323	-0.075	-0.061
Group 4		**1.721**	**1.126**	**-0.344**	**-0.081**	**-0.048**
	14 Kostroma oblast	1.786	1.137	-0.363	-0.086	-0.045
	25 Chuvashia	1.861	1.131	-0.392	-0.095	0.000
	65 Kamchatka	1.590	1.167	-0.266	-0.060	-0.056
	49 Altai krai	1.741	1.032	-0.407	-0.099	-0.076
	7 Leningrad	1.702	1.135	-0.333	-0.078	-0.054
	5 Murmansk	1.610	1.134	-0.296	-0.068	-0.110
	66 Magadan	1.753	1.020	-0.418	-0.103	-0.019
	39 Saratov	1.758	1.161	-0.340	-0.080	0.021
	9 Pskov	1.712	1.124	-0.343	-0.081	-0.083
	8 Novgorod	1.769	1.146	-0.352	-0.083	-0.089
	30 Kursk	1.757	1.134	-0.355	-0.084	-0.037
	29 Voronezh	1.705	1.167	-0.316	-0.073	-0.039
	51 Novosibirsk	1.688	1.104	-0.346	-0.081	-0.097
	13 Kaluga	1.690	1.151	-0.319	-0.074	-0.047
	18 Ryazan	1.707	1.128	-0.339	-0.080	-0.027
	27 Nizhnii Novgorod	1.704	1.152	-0.324	-0.075	-0.007
Group 5		**1.644**	**1.118**	**-0.318**	**-0.074**	**-0.039**
	22 Yaroslav	1.667	1.095	-0.343	-0.081	-0.050
	19 Smolensk	1.664	1.126	-0.323	-0.075	-0.063
	32 Tambov	1.678	1.172	-0.302	-0.069	-0.007
	38 Samara	1.674	1.132	-0.324	-0.075	-0.060
	37 Penza	1.741	1.117	-0.358	-0.085	-0.075
	31 Lipetsk	1.694	1.173	-0.308	-0.071	0.000
	11 Vladimir oblast	1.747	1.102	-0.369	-0.088	-0.054
	24 Mordovia	1.758	1.158	-0.341	-0.080	0.031
	20 Tver	1.669	1.107	-0.337	-0.079	-0.015
	53 Tomsk	1.616	1.112	-0.312	-0.072	-0.070
	21 Tula	1.641	1.124	-0.315	-0.073	-0.032
	12 Ivanovo	1.674	1.044	-0.376	-0.090	-0.071
	17 Orel	1.644	1.173	-0.286	-0.065	-0.103
	16 Moscow oblast	1.444	1.051	-0.272	-0.062	-0.038
	15 city of Moscow	1.502	1.192	-0.206	-0.045	-0.022
	6 St. Petersburg	1.486	1.008	-0.322	-0.075	0.007

Sources: Goskomstat (1996), INED (1996, 1998), Zakharov and Ivanova (1996), and author's own calculation
Note: There are 65 observations (missing region: Kabarovsky kray)

Appendix 4.2

Russian Rural Fertility Rate by Group of Regions, 1980-95

		TFR 1990	TFR 1995	Chg TFR 1990-95	Avg an. chg TFR 1990-95	chg birth rate 1980-88
Group 1		**3.278**	**2.452**	**-0.254**	**0.082**	**-0.059**
	56 Tuva	3.812	3.444	-0.097	0.047	-0.020
	55 Buryatia	3.381	1.946	-0.424	0.069	-0.105
	33 Kamykia	3.009	2.395	-0.204	0.070	-0.045
	60 Chita	3.248	2.153	-0.337	-0.028	-0.079
	59 Irkutsk	3.237	2.024	-0.375	0.013	-0.090
	41 Bashkortstan	3.049	2.262	-0.258	0.154	-0.058
	61 Yakutia	3.210	2.940	-0.084	0.249	-0.017
Group 2		**2.777**	**1.785**	**-0.358**	**0.022**	**-0.085**
	52 Omsk	2.724	1.940	-0.288	-0.083	-0.066
	23 Mari El	2.753	1.787	-0.351	0.073	-0.083
	45 Perm	2.785	1.756	-0.369	0.065	-0.088
	25 Chuvashia	2.944	1.995	-0.322	0.139	-0.075
	42 Udmurtia	2.790	1.705	-0.389	0.042	-0.094
	64 Amur	2.812	1.722	-0.388	-0.103	-0.093
	3 Arkhangelsk	2.634	1.587	-0.397	0.016	-0.096
Group 3		**2.544**	**1.674**	**-0.342**	**0.060**	**-0.081**
	47 Chelyabinsk	2.754	1.713	-0.378	0.079	-0.091
	50 Kemerovo	2.629	1.675	-0.363	0.000	-0.086
	35 Astrakhan	2.821	1.819	-0.355	0.150	-0.084
	34 Tatarstan	2.823	2.113	-0.252	0.262	-0.056
	2 Komi	2.271	1.630	-0.282	-0.022	-0.064
	53 Tomsk	2.468	1.485	-0.398	-0.069	-0.097
	62 Primorski krai	2.528	1.754	-0.306	-0.092	-0.070
	39 Saratov	2.623	1.758	-0.330	0.123	-0.077
	10 Bryansk	2.605	1.872	-0.281	0.241	-0.064
	49 Altai krai	2.515	1.491	-0.407	-0.037	-0.099
	43 Kurgan	2.618	1.597	-0.390	0.036	-0.094
	36 Vologda	2.663	1.821	-0.316	0.051	-0.073
	44 Orenburg	2.900	1.980	-0.317	0.141	-0.073
	26 Kirov	2.561	1.557	-0.392	0.013	-0.095
	24 Mordovia	2.208	1.643	-0.256	0.054	-0.057
	4 Volgograd	2.582	1.669	-0.354	0.068	-0.084
	40 Ulyanovsk	2.546	1.638	-0.357	0.119	-0.084
	14 Kostroma	2.547	1.432	-0.438	0.187	-0.109
	54 Tyumen	2.417	1.678	-0.306	0.043	-0.070
	30 Kursk	2.324	1.720	-0.260	0.105	-0.058
	38 Samara	2.339	1.613	-0.310	0.212	-0.072
	68 Kalingrad	2.333	1.540	-0.340	-0.016	-0.080
	1 Karelia	2.265	1.354	-0.402	-0.081	-0.098
	46 Sverdlovsk	2.668	1.658	-0.379	0.024	-0.091
	51 Novosibirsk	2.593	1.631	-0.371	-0.095	-0.089
Group 4		**2.343**	**1.608**	**-0.313**	**0.136**	**-0.075**
	58 Krasnoyarski krai	2.839	1.816	-0.360	0.000	-0.085
	67 Sakhalin	2.482	1.439	-0.420	-0.048	-0.103
	28 Belgorod	2.367	1.762	-0.256	0.223	-0.057
	65 Kamchatka	2.083	1.522	-0.269	-0.020	-0.061
	66 Magadan	2.397	3.181	0.327	-0.077	0.058
	9 Pskov	2.317	1.459	-0.370	0.200	-0.088
	8 Novgorod	2.409	1.534	-0.363	0.258	-0.086
	29 Voronezh	2.167	1.554	-0.283	0.138	-0.064
	13 Kaluga	2.292	1.460	-0.363	0.147	-0.086
	18 Ryazan	2.291	1.475	-0.356	0.167	-0.084
	27 Nizhnii Novgorod	2.251	1.537	-0.317	0.161	-0.073
	22 Yaroslav	2.281	1.413	-0.381	0.138	-0.091
	19 Smolensk	2.406	1.544	-0.358	0.195	-0.085
	32 Tambov	2.274	1.564	-0.312	0.155	-0.072
	37 Penza	2.326	1.579	-0.321	0.118	-0.075
	31 Lipetsk	2.191	1.533	-0.300	0.180	-0.069
	11 Vladimir	2.245	1.411	-0.371	0.052	-0.089
	20 Tver	2.532	1.466	-0.421	0.218	-0.104
	21 Tula	2.228	1.527	-0.315	0.183	-0.073
	12 Ivanovo	2.298	1.317	-0.427	0.095	-0.105
	17 Orel	2.525	1.670	-0.339	0.370	-0.079
Group 5		**1.648**	**1.148**	**-0.298**	**0.026**	**-0.069**
	16 Moscow oblast	1.726	1.176	-0.319	0.008	-0.074
	5 Murmansk	1.493	1.213	-0.188	0.063	-0.041
	7 Leningrad	1.724	1.055	-0.388	0.008	-0.094

Sources: Goskomstat (1996), INED (1996, 1998), Zakharov and Ivanova (1996), and author's own calculation

Appendix 4.3

Regional Data, Russia, 1990-95

	Industrial Production 1990-95 *(avg an. chg)*	Fertility Rate 1990-95 Total *(avg an. chg)*	Urban *(avg an. chg)*	Rural *(avg an. chg)*	Unemployment rate 1994 (LFS)	Urban Population 1995 (share in total pop)
Kareliya	-0.109	-0.090	-0.091	-0.098	0.077	0.743
Komi	-0.106	-0.073	-0.076	-0.064	0.090	0.749
Arkhangelst	-0.103	-0.090	-0.086	-0.096	0.101	0.734
Volgograd	-0.072	-0.085	-0.084	-0.084	0.072	0.672
Murmansk	-0.094	-0.065	-0.068	-0.041	0.103	0.924
City of St. Petersburg	-0.163	-0.075	-0.075	0.000	0.091	1.000
Leningrad	-0.094	-0.083	-0.078	-0.094	0.101	0.660
Novgorod	-0.109	-0.084	-0.083	-0.086	0.078	0.708
Pskov	-0.199	-0.083	-0.081	-0.088	0.115	0.651
Bryansk	-0.189	-0.068	-0.072	-0.064	0.080	0.683
Vladimir	-0.159	-0.088	-0.088	-0.089	0.096	0.801
Ivanovo	-0.214	-0.093	-0.090	-0.105	0.132	0.823
Kaluga	-0.144	-0.078	-0.074	-0.086	0.051	0.736
Kostroma	-0.180	-0.092	-0.086	-0.109	0.085	0.661
the city of Moscow	-0.159	-0.045	-0.045	0.000	0.061	1.000
Moskow oblast	-0.172	-0.064	-0.062	-0.074	0.082	0.797
Orel	-0.180	-0.069	-0.065	-0.079	0.058	0.627
Ryazansk	-0.155	-0.080	-0.080	-0.084	0.062	0.678
Smolensk	-0.116	-0.077	-0.075	-0.085	0.066	0.696
Tver	-0.159	-0.085	-0.079	-0.104	0.066	0.724
Tula	-0.119	-0.072	-0.073	-0.073	0.062	0.813
Yaroslav	-0.163	-0.082	-0.081	-0.091	0.079	0.808
Mari El	-0.159	-0.085	-0.088	-0.083	0.085	0.622
Mordovia	-0.194	-0.072	-0.080	-0.057	0.074	0.586
Chuvashia	-0.176	-0.087	-0.095	-0.075	0.091	0.604
Kirov	-0.144	-0.087	-0.083	-0.095	0.096	0.702
Nizhnii Novgorod	-0.113	-0.075	-0.075	-0.073	0.060	0.778
Belgorod	-0.066	-0.065	-0.072	-0.057	0.047	0.645
Voronezh	-0.167	-0.068	-0.073	-0.064	0.051	0.615
Kursk	-0.103	-0.074	-0.084	-0.058	0.057	0.599
Lipetz	-0.080	-0.069	-0.071	-0.069	0.052	0.633
Tambov	-0.109	-0.070	-0.069	-0.072	0.070	0.575
Kalmykiya-Halmg	-0.163	-0.058	-0.077	-0.045	0.125	0.378
Tatarstan	-0.085	-0.070	-0.079	-0.056	0.058	0.734
Astrakhan	-0.083	-0.076	-0.069	-0.084	0.088	0.670
Volgograd	-0.163	-0.073	-0.076	-0.073	0.066	0.743
Penza	-0.163	-0.081	-0.085	-0.075	0.076	0.640
Samara	-0.097	-0.074	-0.075	-0.072	0.058	0.804
Saratov	-0.148	-0.077	-0.080	-0.077	0.078	0.739
Ulyanovsk	-0.074	-0.083	-0.084	-0.084	0.057	0.726
Bashkortostan	-0.094	-0.065	-0.073	-0.058	0.060	0.646
Udmurt	-0.151	-0.093	-0.094	-0.094	0.083	0.699
Kurgan	-0.159	-0.091	-0.090	-0.094	0.090	0.548
Orenburg	-0.094	-0.076	-0.078	-0.073	0.056	0.641
Perm	-0.103	-0.084	-0.084	-0.088	0.083	0.764
Sverdlovsk	-0.148	-0.076	-0.074	-0.091	0.080	0.876
Chelyabinsk	-0.144	-0.083	-0.082	-0.091	0.078	0.813
Altai	-0.163	-0.096	-0.099	-0.099	0.075	0.521
Kemerov	-0.097	-0.076	-0.075	-0.086	0.086	0.868
Novosibirsk	-0.137	-0.082	-0.081	-0.089	0.080	0.738
Omsk	-0.126	-0.069	-0.074	-0.066	0.068	0.674
Tomsk	-0.066	-0.077	-0.072	-0.097	0.093	0.653
Tyumen	-0.088	-0.067	-0.066	-0.070	0.068	0.761
Buryatia	-0.123	-0.093	-0.085	-0.105	0.098	0.594
Tyva	-0.129	-0.047	-0.062	-0.020	0.096	0.481
Krasnoyarski	-0.100	-0.079	-0.075	-0.085	0.080	0.737
Irkutsk	-0.085	-0.084	-0.083	-0.090	0.086	0.794
Chita	-0.185	-0.063	-0.054	-0.079	0.077	0.631
Saha (Yakutiya)	-0.056	-0.040	-0.056	-0.017	0.058	0.645
Primorsky	-0.109	-0.081	-0.085	-0.070	0.078	0.777
Kabarovsky	-0.199	-0.097	-0.097	-0.088	0.101	0.807
Amur	-0.140	-0.084	-0.080	-0.093	0.090	0.663
Kamchatka	-0.140	-0.060	-0.060	-0.061	0.100	0.808
Magadan	-0.094	-0.097	-0.103	0.058	0.102	0.870
Sakhalin	-0.103	-0.094	-0.091	-0.103	0.089	0.851
Kaliningrad	-0.180	-0.076	-0.077	-0.080	0.091	0.781

Sources: Goskomstat (1996), INED (1996, 1998) and author's own calculation

Appendix 4.4

Testing for Multi-collinearity

One of the assumptions of the multiple regression model is that there is no exact linear relationship between any of the independent variables in the model. If such a linear relationship does exist, we say that perfect collinearity exists[99].

Let us assume that variables X_1 and X_2 are perfectly collinear because $X_1 = 5\ X_2$ for each observation of the sample. When both variables appear in the regression, we are faced with an impossible problem. The coefficient of the X_1 variable is a partial regression coefficient measuring the change in Y associated with a unit change in X_1 *with all other variables constant.* Since it is impossible to keep all other variables constant, we are not able to interpret (or even define) the regression coefficient.

In practice, the problem is essentially that independent variables have a high degree of multi-collinearity. Multi-collinearity arises when two or more variables (or combination of variables) are highly (but not perfectly) correlated with each other. In this case, it will be possible to calculate the least-squares estimates of the regression coefficients, but the interpretation of the coefficients will be quite difficult. The regression coefficient of the first of the two highly correlated variables is interpreted to measure the change in Y due to a change in the variable in question, *other things being equal.* But, the presence of multi-collinearity implies that there will be very little data in the sample to give one confidence about such an interpretation. Any time a given change in one variable occurs, the corresponding observation on its highly correlated partner is likely to change predictably.

In my regression, I could reasonably expect $\Delta IP_{90\text{-}95}$, the change in the volume of industrial production, to be highly correlated with $UNEMP_{94}$, the unemployment rate variable. There is therefore a need to investigate whether there is a possibility of multi-collinearity.

The easiest way to tell whether multi-collinearity is causing problems is to examine the standard errors of the coefficients. If several coefficients have high standard errors and dropping one or more variables from the equation lowers the standard errors of the remaining variables, multi-collinearity will be the source of the problem.

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[99] For an introductory treatment of multi-collinearity, see Pindyck and Rubinfeld (1991).

Table 4.4.1 reports the standard errors for each variable of the first regression in the main text (change in TFR). It shows that the standard errors are low, and that dropping for example, the unemployment rate $UNEMP_{94}$, does not significantly lower the standard errors of the other coefficients. This suggests that there is no problem of multi-collinarity in this multiple regression[100].

Table 4.4.1

Regression Results of the Change in TFR, Russia, 1990-95
(standard errors in parenthesis)

		constant	chg in $IP_{90\text{-}95}$	DUM2	$UNEMP_{94}$	METROP	URBAN95	R-squared
Chg in $TFR_{90\text{-}95}$	(1)	-0.034	0.093	-0.038	-0.164	0.029	-0.027	0.249
		(0.012)	*(0.050)*	*(0.025)*	*(0.079)*	*(0.009)*	*(0.013)*	
	(2)	-0.041	0.121	-0.039		0.031	-0.030	0.195
		(0.012)	*(0.049)*	*(0.026)*		*(0.009)*	*(0.013)*	

Sources: Goskomstat (1996), INED (1996, 1998) and author's own calculation

[100] An alternative measure is the coefficient of correlation between the change in industrial production and the unemployment rate (correlation = -0.348). The low correlation is consistent with the labour hoarding phenomenon, well-documented in Russian enterprises.

V. Decision about an Incremental Child under Broad Uncertainty:

A Preliminary Discussion

"The more complex and unique the issues we confront,
the more uncertain the outcome"
Douglass North, 1990

Introduction

This chapter attempts to reconcile the standard economic theory of reproductive behaviour and empirical findings by building a simple model. It is based on my findings that reproductive decisions cannot entirely be explained by a change in income: the rise in people's perception of uncertainty, the growing sense of anxiety and lack of confidence in the future, are likely to be significant factors in reproductive decisions as well. The model shows how the lack of confidence in tomorrow can affect individual reproductive decisions.

If uncertainty is present in Western Europe, it is even more prevalent in transition Europe. I will show that rapid economic and political transformations in Central and Eastern Europe have made everyday life broadly uncertain. The presence of widespread, broad uncertainty enhances the complexity of individual decision-making, and affects individual behaviour. The key question is how does uncertainty influence individual decision-making, particularly *vis-à-vis* children.

Despite its significance, 'uncertainty' is largely ignored in the economic model of reproductive behaviour: Becker assumes that agents are well informed about the present and can rationally decide now how many children they will have in the course of their life. This chapter extends this simple model and investigates how broad uncertainty can help explain the rapid fertility decline in transition Europe.

This chapter does not pretend to give a full account of the effect of uncertainty on reproductive decisions. Rather, it shows, with the help of a simple model, that the treatment of uncertainty deserves more analysis. It also gives insight into the rapid fertility declines in Slovenia, Poland or the Czech Republic. Compared to Russia, those countries experienced a continuous fall in their fertility rate, while their aggregate income has been steadily growing.

The structure of the chapter is as follows: section 1 shows that broad uncertainty pervades every facet of life in transition Europe. Section 2 examines the standard behavioural assumptions of economic theory under uncertainty. Section 3 develops a simple model of reproductive decision under broad uncertainty. Section 4 shows how 'uncertainty' can help to understand rapid fertility declines in countries where income has long been growing.

1. Broad Uncertainty in Transition Economies

"All human endeavors are constrained by our limited and uncertain knowledge—about external events past, present, and future; about the laws of Nature, God, and man; about our own productive and exchange opportunities; about how other people and even we ourselves are likely to behave." (Hirshleifer and Riley 1992). "However hard we may try to avoid it, everyday's decisions have to be made in an uncertain world—a world of ignorance, doubt, haziness and hesitation." (Hey 1979).

If uncertainty is inherent to modern economic life, it is even more so in a time of rapid economic and political transformations[101]. Alexander (1998) depicts the environment: "For a people long accustomed to the granite-like immobility of state structures in the USSR, the 'disappearance' of the State in the Russian successors has created great confusion and uncertainty". In what follows, I will argue that transition Europe does not only feature uncertainty, but also broad uncertainty. This section attempts to define the concept of broad uncertainty.

I define an environment as 'broadly uncertain' whenever people *perceive* that there is widespread unpredictability. In transition Europe, people are uncertain about the institutional environment (and preferences), prices and income.

1.1. Institutional Uncertainty

As argued above, prior to transition, Central and Eastern European countries were characterized by the "granite-like immobility of ... State structures" (Alexander 1998). These structures gave stability to human interaction. At present, transition Europe is characterized by two problems regarding institutions[102]:

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[101] Attention has been been paid to certain forms of uncertainty in the analysis of the disincentive effects of benefits in transition Europe by, *inter alia*, Dustmann and Micklewright (1993).

[102] Institutions (the State and the broader society) are providing for the formal (laws and regulations) and informal rules and norms (World Bank 1997). For North (1990), "our lives are made up of routines in which the matter of choices appears to be regular, repetitive, and clearly evident, so that 90 percent of our actions in a day do not require much reflection. But in fact, it is the existence of an imbedded set of institutions that has made it possible for us not to have to think about problems or to make such choices. We take them for granted, because the structure of exchange has been institutionalized in such a way as to reduce uncertainty". Failure to provide a stable institutional environment results in increased transaction costs and reduction in economic activity (North 1990).

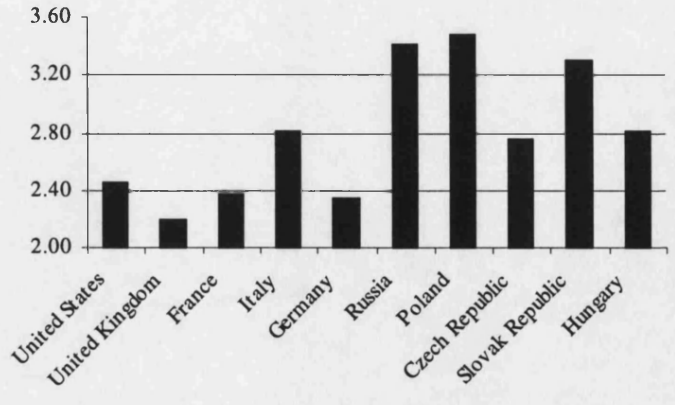
1. The first problem concerns the lack of confidence *vis-à-vis* existing institutions. The lack of people's trust is a particularly acute problem in transition economies. In Russia, for example, an opinion poll carried out between June 1993 and March 1994 shows a remarkable fall in confidence *vis-à-vis* all institutions, i.e. government, President, army, trade unions, Press, TV, except the Orthodox Church (Vciom 1994).

2. The second problem concerns the lack of institutions adequate to market economies. "The many institutions that support market exchange and shape private ownership in advanced market economies—both concrete organizations and abstract rules of the game—largely disappeared under central planning" (World Bank 1996). The challenge of transition is to reinstate those institutions.

"Prior to the Gorbatchev period, Soviet citizens had become unaccustomed to anything more radical than incremental change—in sharp contrast with Western societies, in which recent change has been driven by rapid technological advances, economic fluctuations and political variability. Whereas Western processes of change occur on the bedrock of constitutional and (especially in the case of Great Britain) common law, the tectonic nature of Russian reforms means that they are disrupting Russia at all levels as society is being overturned in a seemingly headlong rush toward the reconstruction of political and economic institutions" (Alexander 1998).

To illustrate the magnitude of the problem, I constructed an overall indicator of 'institutional uncertainty', based on cross-country private sector large-scale surveys data, that were recently made available by the World Bank (World Bank 1997)[103]. As shown in

Figure 5.1: Index of "Institutional Uncertainty", 1996



Source: World Bank data, 1997; author's own calculation

[103] Appendix 5.1 explores the index of institutional uncertainty.

figure 5.1, the indexes of 'institutional uncertainty' are markedly higher in Central and Eastern Europe, than in Western Europe. Russia exhibits one of the highest indexes of 'institutional uncertainty' in the region.

As a result, individuals in transition Europe are often unable to identify their tastes (or preferences). When asked about what they want, people express only vague hope and exhibit a generalized lack of confidence in tomorrow (Alexander 1998)[104].

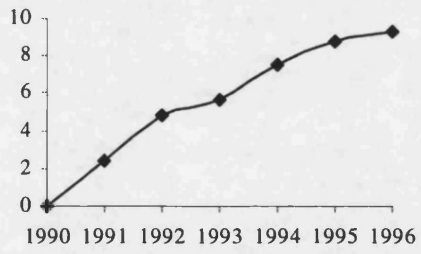
1.2. Price Uncertainty

For people who never before experienced inflationary conditions, the rise of inflation has created tremendous uncertainty on the current and future purchasing power of income. In Russia, for example, annual inflation increased by more than 1,500 percent during the worst episode of hyper-inflation (UNECE 1998). In other Central and Eastern European countries, inflation has been lower than in Russia, but it is still high and shows resilience to decrease. This indicates that there is still a major potential for macroeconomic instability in transition Europe.

1.3. Income Uncertainty

For economies that previously guaranteed the right to work (and a stable income), the emergence of unemployment increased the uncertainty regarding the ability to keep or find a job. Most transition economies experienced a rise from a virtually zero-level to more than 10 percent during the transition period. Figure 5.2 shows the Labour Force Survey unemployment rate in Russia (RET 1997). The worst fear in the early days of the transition was that a high level of unemployment would persist over time. This fear has been consolidated over time: unemployment fell only slightly despite economic recovery. In Slovenia, for example, the 1997 unemployment rate rose to 14.8 percent despite a 3.3 percent annual GDP growth (UNECE 1998). This indicates that high unemployment rates are part of the transition context.

Fig.5.2: Unemployment rate, Russia, 1990-96



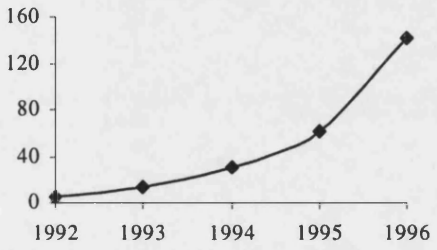
Source: Russian Economic Trends, 1997.

[104] An opinion poll survey carried out on the Russian urban population in 1994 shows that more than a third of the interviewees (35 %) was unable to say what would their family's wellbeing be in a year from now; another third (31 %) responded that it would be worse (Vciom 1994).

As discussed in Chapter IV, the presence of unemployment rates similar to those in Western Europe suggest that the level of uncertainty is identical in Western and Eastern Europe. This is clearly not the case. Uncertainty regarding job opportunities and future income is much larger in Eastern Europe[105].

In some transition economies, income uncertainty is further exacerbated by the culture of non-payment of wages[106]. Figure 5.3 shows the rise in wage arrears, as a share of the monthly wage bill in the industrial sector in Russia. This figure gives some indication of the magnitude of the problem. People who do not get paid or are not paid on time, are officially registered as employed, and are therefore expected to live on their income. In reality, they share all the characteristics of regarding the perception of future income and job opportunities unemployed (except in receiving benefits).

Fig 5.3: Ratio of Wage Arrears to Monthly Wage Bill in the Industry, Russia, 1992-96
(in percent)



Source: Russian Economic Trends,1997

1.4. Definition of 'Broad Uncertainty'

I define the concept of 'broad uncertainty' in two terms:

- Aggregated nature of the concept: broad uncertainty qualifies both the microeconomic *and* macroeconomic environment in which people live;
- Subjective nature of the concept: broad uncertainty is purposefully defined in terms of people's perception of the environment. In some cases, people's perceptions coincide to objective facts. More often, people's perception can differ from objective facts. For example, in a country where unemployment was high for a long time, but recently fell, people may still perceive that

[105] The utility cost of being unemployed is higher in transition Europe than in the West. Under communism, only rogues, vagabonds, drunkards, wastrels and idiots had no job; thus being unemployed involved personal failings and/or culpability. This is far less the case in the West where a) we all know good people who have been unemployed, and b) at least some of us accept the idea of involuntary unemployment. What all this leads to is that a given aggregate unemployment rate is more uncertainty-inducing in transition Europe than in the West. I am grateful to Nick Barr for this point.

[106] The problem of wage arrears in Russia has been empirically investigated, *inter alia*, by John Earle and Klara Sabirianova (1999). I am grateful to John Earle for useful discussions. Wage arrears are generally considered as a typical Soviet phenomenon. Informal evidence gathered from participants in the conference on the "Causes and Consequences of Wage Arrears in Russia" (Stockholm 1998) suggest that it may have concerned Baltic countries as well.

uncertainty on their ability to keep a job is high. People may then behave *as if* unemployment was still high. As I will show below, the distinction between objective facts and people's perception has far-reaching consequences for the study of individual behaviour[107].

[107] As I will show below, the distinction is useful to capture phenomena like the lack of confidence in tomorrow and anxiety about the future.

2. Economic Theory and Uncertainty

The presence of uncertainty enhances the complexity of individual decision-making. In his *Economics of Uncertainty*, Hey (1979) describes one aspect of this complexity:

> "The economic theory of (household) acting in a world of certainty is a superbly elegant and refined construction: a monument to the skill and perseverance of previous generations of economic theorists...(However), it is clearly superfluous to point out that (these) assumptions do not hold good in a real world...The individual, when considering his inter-good and his inter-temporal allocation problem is faced with a whole set of uncertainties and deficiencies of information.... It would be pleasant to be able to report that the incorporation of uncertainty into consumer theory could be achieved without blemishing the beautiful edifice of certainty theory. Unfortunately, this is not so. Indeed, given the present state of economists' skills in modeling uncertainty, the introduction of uncertainty causes a complete destruction of this edifice."[108]

This section examines the standard model of economic behaviour under uncertainty. I organize the discussion along three questions: what is the object of choice? What structures this choice? What principle leads to this choice? The purpose of this section is to show why the presence of uncertainty poses a challenge to the standard behavioural assumptions of economic theory. This discussion is however tentative and does not pretend to give a full coverage of the issue.

2.1. Context of Choice

The focus of economic theory is on individual choice. The individual is confronted with a set of commodity bundles. Each commodity bundle can be unambiguously and objectively described. The individual has to make a choice among these bundles.

How does uncertainty affect the context of choice? It is generally assumed that, because of uncertainty, the individual does not know, in advance of making his choice,

[108] The "destabilizing" effect of adding uncertainty in game-theoretic analysis has been explored, *inter alia*, by Kreps David M. and Robert Wilson (1982). "Reputation and Imperfect Information". *Journal of Economic Theory* 27, 253-279.

what will be the actual outcome of any particular choice—or which commodity bundle he will end up with.

Why does the individual fail to know the final outcome? Economic theory assumes that the outcome of any particular choice depends on "what the state of the world" is (Hirshleifer and Riley 1992). There are several states of the world possible, and the individual does not know which particular state of the world will actually prevail[109]. This framework assumes that uncertainty arises from a lack of information about the states of the world[110].

To deal with this problem[111], economic models can, for example, assume that individuals can gather this information at a negligible cost (Cukierman 1980); or that they can decide to voluntarily delay their decision on the ground that more information is needed to form probability judgements (Pindyck 1989)[112]. As I will show below, an alternative is to assume that individuals have rational expectations (Newbery 1989)[113]

2.2. Structure of Choice

The computational power of the decision-maker is assumed to be unlimited. This means that each individual is able to process all available information in a consistent way. In other words, the individual behaves perfectly 'rationally' (in the economic sense).

- In the static context, rationality means that individual preferences are internally consistent. The requirement of internal consistency specifies that it is possible to "explain the set of actual choices as resulting from maximization according to some binary relation" (Sen 1998). In even more demanding formulations, "the binary relation is required to be fully transitive, and more demandingly still, even representable by a numerical function

[109] This is the essential difference with risk where individuals are conventionally assumed to be able to attach probabilities to the states of the world (Barr 1998).
[110] Hirshleifer and Riley (1992) distinguishes between the "economics of uncertainty"—where the individual is presumed to act on the basis of current fixed beliefs, and the "economics of information"—where the individual can overcome his ignorance by 'informational actions'.
[111] A related problem concerns the incompleteness of the market structure. The concept of missing future markets is explored, *inter alia*, by David M. Newbery, 1989. "Missing Markets: Consequences and Remedies". In Hahn Frank (ed.). *The Economics of Missing Markets, Information, and Games*. Clarendon Press, Oxford.
[112] I choose to ignore the literature on the optimal level of information.
[113] This means that individuals' beliefs about market-clearing prices that will prevail in each state of the world are correct, that they will base their actions on these beliefs, and the resulting equilibrium confirms these beliefs.

which the person can be seen as maximizing" (Sen 1998)[114]. "Economists traditionally have assumed that, when faced with uncertainty, people correctly form their subjective probabilistic assessments according to the laws of probability. But researchers have documented many systematic departures from rationality in judgement under uncertainty." (Rabin 1998)[115].

- In the dynamic (inter-temporal) context, the rationality assumption can take the form of a rational expectations (RE) requirement. RE is probably one of the most restrictive and unrealistic assumptions about economic behaviour. Yet, because of its widespread use in economic theory, it is important to carefully examine it.

The context under investigation is one in which individuals have to make a decision that involves several periods. Economic theory assumes that there is a connection between the present and the future. In particular, individuals' actual behaviour is affected by the 'views' (or expectations) they hold about the future. How do they form their expectations about the future?

Rational expectations (RE or forward-looking behaviour) gives a specific mould to the process of expectations formation[116]. Individuals are assumed to behave purposefully in collecting and using information, just as they do in other activities[117]. They do not waste information that is scarce when they make their decisions[118]. Expectations are viewed as "informed predictions of future events" (Sheffrin 1996)

[114] The concept of 'rationality' was first discussed in Chapter II, Section 1.

[115] For example, Arrow (1983) argues that the transitivity requirement does not hold—a phenomenon known as preference reversal: "Suitably chosen pairs of gambles can be found with the following characteristics: When subjects are asked to choose between the two, they express a preference for one. But when asked to state the amount of money which, if given with certainty, would be indifferent to each gamble, the amounts chosen are in opposite order to the expressed preferences". He concludes: "no simple rational explanation could be found".

[116] An alternative is 'adaptative expectations' (or backward looking behaviour).

[117] "Efficient utilization" means that the typical individual's perception of the probability distribution of future outcomes (his subjective distribution) conditional on available information, coincides with the actual probability distribution conditional on that information.

[118] It also encompasses the idea of a 'typical' individual. This assumption is used operationally with reference to the aggregate behaviour of individuals. It means that individuals in the aggregate act in a *regular* manner as if each was a typical individual following a *systematic* decision process. In periods of large transformation and uncertainty, this assumption may be unrealistic for there is little evidence of systematic behaviour.

Moreover, individuals form their expectations of future events based on current information and prior beliefs, using Bayes' rule. This rule gives a specific form to the way individuals update their probability distribution when new information comes up: individuals will always give more weight to prior information than to new information. Bayes' rule is a device used to introduce rationality into probability judgments.

Two outcomes are possible if the individual has rational expectations:

1. The individual correctly anticipated a sudden event/shock. This is the simplest case: there is no unpredictable uncertainty. In that case, the actual values of the variables will, on average, equal the expectations—this is often referred as 'perfect foresight'.

2. The individual did not anticipate the shock—the "surprise effect". In this case, the expectations will diverge from actual values only because of some unpredictable uncertainty in the system.

Economists will assume that "surprises" are hard to sustain whenever: 1) information is as up-to-date as in a modern economy, and 2) patterns of economic behaviour are well settled in times. Thus, individuals will be able to correctly anticipate all that can possibly be anticipated in an environment showing considerable stability[119].

What happens in the presence of widespread uncertainty? In a time of rapid economic, political and social transformations, one can reasonably expect that the individual will depart from 'perfect rationality':

1) Information and its update become problematic. Specifically, individuals may misuse Bayes' rule. They will give too little weight to *prior* information and will be overly influenced by *current* information (Arrow 1983). For example, they will exaggerate the current costs of doing something *now*,

[119] All that is not anticipated (and expected) by agents, is purely unpredictable. There are no *systematic errors* related to expectations. This is known as the independence of errors in decision-making.

relative to *tomorrow* (Akerlof 1991)[120]. I will return to this point in the next section[121].

2) Patterns of economic behaviour may be disturbed in an unfamiliar way. Typically, individuals cannot adopt a perfectly rational, forward-looking behaviour. "Surprises" can become the rule, rather than the exception.

2.3. Decision-Making Principle.

Each individual always looks for the first-best outcome: his objective will be to maximize his (inter-temporal expected) utility.

In the presence of uncertainty, the decision rule is however not as simple. For Hey (1979), "there is no universally agreed best procedure (nor, because of the nature of the problem, is one ever likely to be found; perhaps this, more than any other reason, is why economists have steered clear of its analysis)".

Alternative decision rules include, for example, maximin, maximax, minimax regret...and, in Hey's terms, "one can continue to suggest alternative decision rules *ad nauseam*—the patience of the reader being likely to be exhausted before the ingenuity of the inventor!". And, as if it was not already complex enough, alternative rules give rise to different 'first-best' outcomes.

2.4. The Effects of 'Broad Uncertainty'

Thus, in the presence of 'broad uncertainty', the simple economic model of reproductive behaviour can be challenged. In particular, and to summarize what we learnt so far:

- Agents can lack the necessary information to make their decisions—a problem of missing/incomplete information.
- Agents can find it harder to process this information. Perfect rationality (and the RE hypothesis) may be at stake.
- Agents can opt for alternative decisions rules rather than maximization.

[120] Akerlof (1991) shows that, in situations involving repeated decisions, undue salience leads to non-independence of errors in decision making.
[121] Section 3 models the lack of confidence in tomorrow by 'inflating' the cost of having an additional child now, relative to tomorrow.

To sum up, decision-making under 'broad uncertainty' is a highly complex phenomenon; it cannot be confined to an informational problem.

This definition distinguishes informational problems from incapacity 'rationally' to process information (a problem related to 'people's perception of uncertainty'). This distinction can be useful to capture phenomenon like the lack of confidence in tomorrow. 'Fear of the future' is much more related to people's perception of uncertainty, and their capacity to process information, than a lack of information *per se*. I will return to this point in the model below.

3. Reproductive Decisions under 'Lack of Confidence in Tomorrow' : A Simple Model

This section develops a simple economic model of reproductive decision whenever individuals lack confidence in tomorrow. In this model, households can choose between having a child now, or having it later. This decision has to be made in an extremely unpredictable (or broadly uncertain) environment. I assume that this environment affects households in the following way: they perceive that the cost associated in having a child today is 'overly high', compared to having it tomorrow—the salience cost reflects the lack of confidence in tomorrow. As a result, they tend to postpone the birth of a child until tomorrow. If replicated over a large number of households, the individual decision to procrastinate entails an aggregate short-term fall in the fertility rate.

To model households' decision-making process, I use the contributions of Becker-Murphy (1988) and Akerlof (1991) to standard economic analysis[122]. At the end of the section, I will have explicitly introduced 'broad uncertainty' in an individual decision over an incremental child.

3.1. The Model [123]

- Each household (treated as a unit of analysis) has planned the number of children it wants. The decision process investigated here concerns the incremental child, and not the total number of children.

- The household has to make a decision every period.

- Each period, it has to decide between having a child now, or having it tomorrow (postponing the birth)[124]. If it decides to have the child later, it has

[122] Standard economic analysis is based upon the view that individuals have fixed utilities that do not change. Stigler-Becker (1977) and Becker-Murphy (1988) have gone so far as to posit these utilities do change, but that individuals are forward looking and thus foresee the changes that will occur. Based on a more modern view of behaviour, Akerlof (1991) posits that individuals have utilities that do change and, in addition, they fail to foresee those changes or even recognize that they have occurred.

[123] This part reproduces Akerlof's model (1991). His original model gives insight into a range of 'deviant' individual behaviours such as substance abuse.

[124] I assume that there is no uncertainty on the outcomes (or probability associated to these options). This means that each household can fully control when it wants not to have children. As discussed in Chapter III, this is the case in a perfectly contraceptive world, and, arguably, in Russia.

the same options to choose from the next period: have a child now, or have it tomorrow.

- Each period, the household compares the (net) cost of having a child now, with the (net) cost of having it the period immediately after. It will choose the option that minimizes the (net) cost.

- I assume that the 'benefits' of an additional child is a fixed amount x per period.

- The cost of having a child now goes beyond the direct cost in rearing children. It includes the *opportunity cost of having a child* as well. For example, if the household decides to have a child today, one of its members may have to leave his/her job. The opportunity cost of this additional child would be the (lost) wage. For simplicity, I assume that both the direct and the opportunity costs are included in a fixed cost per period, *c*.

- Due to broad uncertainty, each household tends to over-value the cost of having an additional child now relative to any future period, by a factor δ. Uncertainty 'inflates' (artificially) the cost of having a child now[125]. Put in another way, they perceive that the cost for one of its members to leave his/her job today, and find another job tomorrow, is 'overly high'. This specification captures the idea that households lack confidence in tomorrow.

On each period t, each household makes a plan to have a child on date t*. It chooses the period t* to minimize the cost (net of the benefits) of an additional child, V.

- If it decides to have an additional child at date t, V would be:

$$V = c \,.\, (1 + \delta) - (T - t^*) \,.\, x \qquad \text{for } t^* = t \qquad (1)$$

[125] *De facto*, broad uncertainty undermines households' capacity to 'rationally' process information. This means that individuals cease to have rational expectations (or a forward-looking behaviour). I am aware that the violation of the standard assumption of rational expectations drives the procrastination result.

where,

δ represents the extra cost (premium) of having a child due to broad uncertainty; this extra cost represents their 'perception of uncertainty'[126] ; and

T represents the final time of the game.

- If it decides to wait until next period, V would be:

$$V = c - (T - t^*) \cdot x \qquad \text{for } t + 1 \leq t^* < T \qquad (2)$$

From the specifications of the (net) cost functions V in (1) and (2), it is clear that there is an inherent propensity to procrastinate until the next period[127].

Akerlof's original model (1991) assumed that, at time T, the (net) cost is equal to zero (i.e. having a child in the final period does not cost anything (in net terms)). As I will argue below, it is, however, possible to imagine situations where the cost of action in the final period is non-zero, and possibly large.

3.2. Outcomes of the Model

1. Every period, each household postpones the decision of having an additional child. The decision of not having a child in the current period arises because of broad uncertainty--it causes the cost of having a child now to be unduly salient in comparison with future costs. If replicated over a large number of households, the individual decision to procrastinate entails an aggregate short-term fall in the fertility rate.

2. Each household ends up having the additional child at time T. We could however, imagine that the (net) cost of having a child in the last period, V_T is non-zero—or individuals believe it to be zero, but it turns out to be positive. In the final period, households may then have to make a decision between having a child in T and incurring a positive (net) cost; or not having a child in

[126] δ intends to capture the *perception* of uncertainty. As noted in section 1.4, there may be a discrepancy between perception and reality. This point would require further investigation. I assume here that households behave *as if* δ was positive (and δc sufficiently large).

[127] As I will argue below, the decision to have a child has a major asymmetry: having a child is a permanent decision, while postponing it is a temporary choice.

T. In those circumstances, they may decide not to have a child in T. The final outcome is a definite suspension of childbearing.

3.3. Procrastination and Rationality

The model showed that, under certain circumstances, individual households can decide to procrastinate. Assuming that this decision is replicated over a large number of households, it can entail an aggregate short-term fall in the fertility rate.

A separate question concerns 'rationality'. Was the individual decision to procrastinate 'rational'? The model above assumed that procrastination was not a perfectly rational decision to make. In particular, the presence of broad uncertainty impeded households' ability to both maximize over the long-term and being rational over that time horizon. The relaxation of the RE hypothesis led them to decide on not having children in the current period.

Specifically, every period, broad uncertainty led them to postpone their plan until the next period. They failed to foresee that, when the next period came, they would again postpone the decision of having a child tomorrow. If they had had RE, households would have been able to forecast the sequence of postponements, and the utility losses incurred every period. They would have then made the perfectly rational decision (in the economic sense) of having the child in the first period, rather than the last one. Thus, there would have been no short-term, aggregate fall in the fertility rate.

Is the departure from the Rational Expectations hypothesis justified? As argued in section 2.1, the presence of broad uncertainty makes information (and its update) more problematic and disturbs patterns of economic behaviour in 'an unfamiliar way'. Thus, in an environment showing considerable instability, it is reasonable to argue that individuals cannot adopt Rational Expectations (or a forward-looking behaviour).

It could, however, be argued that procrastination was a perfectly rational decision. Although this point would require further exploration, let me expose two alternative hypotheses[128]:

[128] I am grateful to Nick Barr for suggesting those hypotheses.

1. Asymmetric Cost Hypothesis. In an environment where everything is collapsing, individuals maximize their utility (net cost) over a short-term, rather than a long-term horizon. They value the cost of procrastination as 'low' and the cost of not postponing as 'high'. The asymmetric cost structure makes the decision to wait to be 'rational' (bounded rationality).

2. Information Overload Hypothesis. Individuals are surrounded by 'too much' information, often contradictory and easily reversed. In that case, the rational decision consists in not doing anything: the freeze reaction[129].

[129] In the interdisciplinary spirit of the thesis, a reference can be made to the animal world. This hypothesis exactly describes the way a rabbit 'freezes' when caught in a car headlight.

4. The Income – Fertility Dilemma

This section explores how uncertainty can help explain the apparent income-fertility dilemma. The dilemma can be summarized as follows:

- The fall in income generally explains the rapid fall in the fertility rate. The positive relationship between income and fertility lies at the heart of the economic theory of reproductive behaviour, is widely perceived as the primary factor behind the fertility crisis, and was shown by using cross-regional fertility data in Russia.
- Income recovered in most countries of central Europe; yet, the total fertility rate has not turned around.

The Slovenian, Polish and Czech cases are particularly interesting in this respect. Here are three Central European countries, quite advanced in the process of economic and political reforms, growing for the last four years (at least) at steady rates. Yet, their current fertility rates are a third of what they were at the beginning of the transition process.

The Slovenian and Czech cases[130] illustrate how complex the relationship between income and fertility can become in the presence of broad uncertainty. At first sight, there are two sorts of countries:

- Russia, where fertility has been falling because income collapsed and uncertainty rose. This relationship was shown in Chapter IV.
- Slovenia and the Czech Republic, where fertility has been falling, while income has been steadily *growing*.

The Slovenian example may be consistent with evidence from Russia, and in particular, with a *positive* relationship between changes in income and fertility, if people's perception of uncertainty is accounted for[131].

[130] Poland may however be a particular case: religious factors affect predominantly reproductive choice. Some argue that the decline in fertility in traditionally fecund Catholic countries demonstrate a decline in the Church's influence and gains in wealth which have lead to postponement of marriage and raising a family.

[131] Thus, 'people's perception of uncertainty' gives insight into the Slovenian fertility decline, without postulating a change in attitudes (i.e. when people have more money they want to spend it on other things than children) or a 'substitution effect' of Becker's type.

Although this point requires further investigation, a high perception of uncertainty could help to resolve the apparent income-fertility dilemma. Indeed, some countries of Central Europe may have recovered from the initial transition shocks; yet, their people can still *perceive* that uncertainty remained high, and exhibit a generalized lack of confidence in tomorrow. The effect of 'people's perception of uncertainty' on reproductive decisions can be so strong that it outweighs the gains from increased income.

'People's perception of uncertainty' can go well beyond job opportunities and future income[132]. It may encompass uncertainty on housing. For example, young couples perceive that they have little prospects to find a place to live (Shapiro 1998). This is obviously a serious constraint when deciding for a child. Another uncertainty concerns kindergarten facilities (Cornia 1995). With transition, most of these facilities that were free in the 1980s either disappeared, or became privately owned (and expensive). Uncertainty as to whether parents will be able to find a place in such a facility, may become a serious impediment to having children as well.

[132] It includes income from labour and benefits (e.g. family benefits that were guaranteed by the state before transition).

Conclusions

In a preliminary investigation, this chapter explored the specific connection between reproductive decisions and people's perception of uncertainty. It began to show that Central and Eastern Europe feature 'broad uncertainty'. Individuals have to make individual decisions in an environment characterized by institutional, prices and income uncertainties. The presence of uncertainty enhances the complexity of individual decision-making.

It then explored the prevailing economic paradigm under uncertainty. In a preliminary discussion, it shows that most behavioural assumptions of economic theory are disputable in the presence of uncertainty:

1. Complete Information. Under uncertainty, individuals often lack the necessary information to make their decisions;
2. Perfect Rationality. Under uncertainty, individuals can find it harder to 'rationally' process information;
3. Optimization Behaviour. Under uncertainty, individuals can opt for alternative decision rules than maximization.

In an attempt to reconcile the economic model of reproductive behaviour with uncertainty, I develop a simple model. In this model, each household can choose between having a child now, or having it later. But the presence of uncertainty undermines the household's capacity to process information: it *perceives* that the cost of doing something now is 'overly high', compared to doing it tomorrow. As a result of this extra cost, each household puts off the birth of the additional child. If the individual decision to procrastinate is replicated over a large number of households, it will entail an aggregate short-term fall in the total fertility rate.

Although further investigation is required to confirm this point—notably empirically testing this hypothesis, 'people's perception of uncertainty' can also give insight into the rapid fertility decline in Slovenia (Poland and the Czech Republic). In those countries, the total fertility rate continued to fall, while aggregate income has been steadily growing. The positive income-fertility relationship that characterized the Russian case can be recovered if 'people's perception of uncertainty' is taken into account. For example, the rapid Slovenian fertility decline can be explained by 'broad uncertainty', the

effects of which are so strong that it supplants any improvement in income and holds the fertility rate down.

To sum up, this chapter opened a new avenue to investigate the causes of fertility decline in general. It showed that the treatment of uncertainty in the economic theory of reproductive behaviour deserves more analysis.

Appendix 5.1

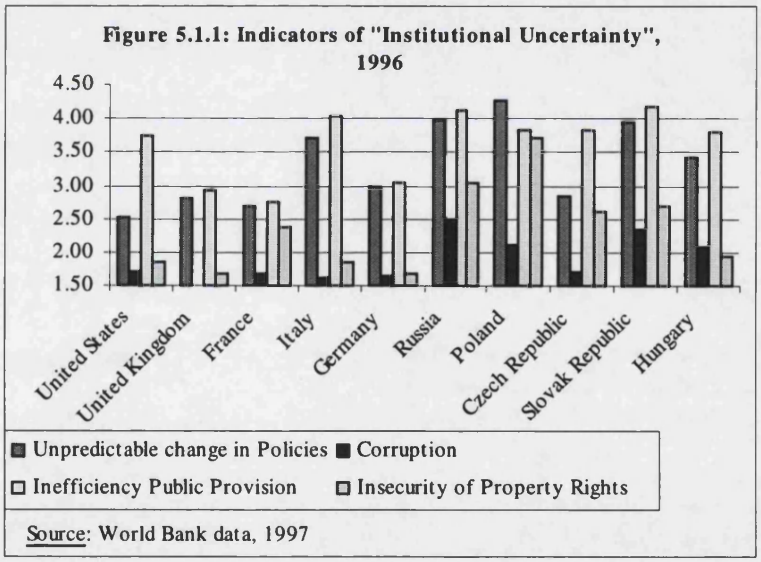
Index of Institutional Uncertainty

To illustrate the scope of institutional uncertainty in transition Europe, I used cross-country private sector large-scale survey data that were recently made available by the World Bank (World Bank 1997). The survey was carried out in 1996 on local entrepreneurs of 28 countries[133]. Its aim was to capture local entrepreneurs' views vis-à-vis the reliability of the institutional framework. The following aspects of the institutional framework were assessed:

1) predictability of changes in law and policies;
2) importance of discretionary and corrupt bureaucracies;
3) efficiency in public provision of some services (for example: customs, roads, mail delivery, public health care provision); and
4) Government's protection of property rights.

Figure 5.1.1 shows the results of the survey for some countries. In Russia, for example, local entrepreneurs perceive that the State fails to apply law and policies predictably, ensure efficient public provision of services, enforce property rights, and is corrupt. Large values for each indicator of reliability of the institutional framework suggest a large degree of *perceived* uncertainty by local entrepreneurs.

Figure 5.1.1: Indicators of "Institutional Uncertainty", 1996



Source: World Bank data, 1997

[133] Unfortunately, the survey did not include Slovenia. The questionnaire consisted of 25 multiple choice questions. Questions aimed at identifying the degree of uncertainty created by State action. For example, the survey asked: "Do you expect the government to stick to announced major policies". Options ranged from 1 (always) to 6 (never). Those questions were asked to "private sector entrepreneurs" in companies of various sizes, sectors of activity, locations (including or not foreign participation, and exporting or not).

Compared to some Western European countries (with the exception of Italy), Central and Eastern European countries show lesser reliability of the institutional framework, and thus, a larger degree of uncertainty.

To construct the overall indicator of 'institutional uncertainty', I compounded the four indicators of reliability described above[134].

[134] The sample survey results shown in figure 5.3 cover four questions (one in each of the category described above). The value obtained for each indicator represents the country mean for the complete sample. On measurement problems, see World Bank (1997).

VI. Summary and Policy Conclusions

"It is reasonable to suppose that in a not too distant future we shall be competent to understand so simple a thing as a star"
A.S. Eddington[135]

Introduction

This inquiry started from a general concern about the social impact of the transition process in Central and Eastern Europe. Initially, the transition towards a market-based system was expected to bring positive changes to the life of all. Far-reaching economic and political reforms initiated in 1989 were universally hailed as the harbingers of greater freedom, fast economic growth and rapid improvements in standards of living (Cornia 1995).

Although progress would be realized in some areas, it rapidly became clear that transition would take time and be costly. *De facto*, transition entailed institutional weakening, political uncertainty and large economic dislocations[136]. The expected rapid growth of the economy has turned into a generalized recession of phenomenal proportions.

The short-run impact of transition has been very negative on the standards of living of the population. Throughout the region, unemployment rose sharply, income inequalities deepened and poverty exploded. Even in countries where economic growth has been recovering, the deterioration in income-based indicators has not yet approached a turning point. UNICEF (1997) declares the ascent of a "social crisis"[137].

But, transition did not only affect the standards of living of people, and their position in society; it also altered their individual capabilities to function, that is, their ability to have a long and healthy life, be well nourished, literate and safe. This, in turn, affected their well-being.

To appreciate the welfare loss, Shapiro (1995, 1997) examined the crude death rates in Russia. Her pioneering studies suggested a close link between the sharp upsurge in the Russian crude death rate, and the "crisis of transformation". "Russia's mortality

[135] I am grateful to Professor Roxburgh for this quote.
[136] According to Cornia (1995), the transition represents "one of the most pronounced cases of collective mis-theorizing and mis-forecasting in recent history".

crisis has its roots in the same unsettled macroeconomic climate which provokes fear about the future shape of Russian society. The key new factor pushing up death rates arguably is increased stress" (Shapiro 1997).

In view of her findings, I started to investigate the demographic counterpart of the death rate: the crude birth rate. In a preliminary investigation, I found that the Russian crude birth rate sharply fell during the 1990s. Evidence gathered in Moscow suggested a link with the transition process (Vandycke 1996a).

As the investigation progressed, I made three findings that set the directions for my future research.

1. Using the crude birth rate to measure fertility can give a misleading picture of what really happened to reproductive decisions during transition. Contrary to what the crude birth rate suggests, reproductive decisions radically changed by the end of the 1980s only. The total fertility rate (TFR) that ignores the effect of the age-sex structure of the population fell sharply from 1989 on, and not three years earlier as the crude birth rate data show (Vandycke 1996b).

2. The demographic problem of Russia lies in fact in reproductive decisions. Even if Russia featured rising death rates, it faced a much sharper decline in the TFR. In this respect, looking at the "scissors" of the falling crude birth rates and rising crude death rates in Shapiro (1995) can be misleading: the figure suggests that the birth rate has been steadily declining for a long time. In fact, fertility decline dramatically accelerated by the end of the 1980s.

3. The accelerated decline in the TFR is repeated throughout the Central and Eastern European region. Thus, it is not a typical post-Soviet phenomenon, like the mortality crisis turned out to be (Shapiro 1995, UNICEF 1997).

The purpose of the inquiry was to investigate the causes for the sharp fall in the total fertility rate across Central and Eastern Europe, by using Russia as a focus. Specifically, this thesis investigated if and how, transition altered the fertility rates. Its expected outcomes were twofold: first, provide empirical evidence (if any) of a

[137] Obviously, UNICEF has no indication on freedom and opportunities.

connection between transition and the change in the TFR; and second, conclude whether the decline in the TFR was a negative indicator of the transition process.

Provided that conclusions can be drawn from the Russian experience for the rest of Central and Eastern Europe, this inquiry found that:

1. Transition, and the economic crisis in particular, has influenced the downturn in the TFR. In a cross-section study, I showed that the decline in the TFR represented the response to lower income and higher uncertainty (insecurity). This finding was particularly interesting for it showed no simple causal link between economic and fertility indicators: a variable such as 'people's perception of uncertainty' contributed to explain the rapid fertility decline as well.

2. Based on those findings, I concluded that the deterioration in the fertility rates represented a strong negative indicator of the transition process: it reflected the deterioration in the quality of life and happiness. In Amartya Sen's terms—and provided that the ability to have the number of children individuals want is part of the "capability of an individual to function", the rapid fall in the TFR indicates a loss in welfare[138].

Policy-makers of transition countries should be concerned by the deterioration in the fertility rates for at least two reasons:

1. Transition raised the hopes to bring positive changes to the life of all. It promised to make people feel better both in providing them with greater political freedom and higher standards of living. This inquiry showed that unhappiness and frustrations are undermining the transition process: policy-makers have hitherto failed to meet the expectations.

2. A sustained fertility decline bears important policy consequences for the future of those countries. In particular, there is a risk that a declining younger generation will find it harder to provide pensions and health care for a large older generation.

The structure of this chapter is as follows: section 1 summarizes each chapter of the inquiry. Section 2 addresses the policy implications of the inquiry. Finally, section 3 suggests some avenues for further investigation.

1. Summary

Chapter I depicts the object of this inquiry: the abrupt, unexpected and virtually unparalleled decline in the Total Fertility Rate (TFR) across Central and Eastern Europe **[Section 1]**. Rapid decline in the TFR is universally repeated throughout the region. It even features the 'successful reformers' of transition Europe, such as Slovenia, Poland and the Czech Republic. This thesis concentrates on Russia, which is experiencing one of the most severe deteriorations in the fertility indicators of the region.

Chapter I discusses why fertility declines are an important subject of investigation and a politically salient issue for Central and Eastern Europe. It argues that accelerated fertility declines to a level well below replacement will entail a net loss of population in those countries. In the long term, this trend is likely to undermine future economic growth. In the medium term, it may threaten the foundations of their 'Welfare States': Central and Eastern Europe, like Western Europe faces the prospect of a rapidly shrinking younger population financing welfare expenditures of a growing proportion of older people.

On the political front, the fertility decline reopened the sensitive debate on immigration, particularly of ethnic minorities from higher fertility regions of the world. More alarmingly, it has been used, in Central and Eastern Europe, to undermine the political support for reforms in those countries. In Russia, the 'fertility crisis' is often attributed to the 'shock therapy' administered to the economy—explicitly blaming over-zealous economic reforms, Western advisors and the international community, and nurturing nationalistic feelings.

Chapter I turns to explore previous research on the subject **[Section 2]**. The present state of knowledge cannot precisely identify the causes for rapid fertility declines in general, and of Central and Eastern Europe in particular. The field on reproductive choice often emerges as a collection of prior beliefs, popular perceptions and speculations.

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[138] In an original approach, this investigation integrated income-based welfare criteria (aggregate

In the literature on transition, it became conventional wisdom to attribute the rapid fertility decline to the process of economic and political transition. The causal links through which transition is connected to rapid fertility declines are, however, far from clear. There are at least two reasons to justify further investigation. First, in Russia, the crude birth rate started to fall *before* the 1992 introduction of market reforms. Second, the mechanisms through which transition may have affected fertility can be many-fold. To cite a few of them: the deterioration in living standards (and the increase in the opportunity cost of children); a shift towards modern Western individualistic values; another shift in the incentives structure; the lack of new flats; or broad uncertainty associated with rising unemployment.

This thesis chooses to investigate two particular mechanisms of transmission. The choice of those mechanisms is based on the fact that they are consistent with popular perceptions of the fertility decline, and have been widely used in the Transition literature as validated hypotheses. These are:

1. Fertility fell in response to the spread of Western individualistic values to the East that accompanied transition. In the process of 'adaptation' towards Western fertility levels, a new system of values and attitudes towards family formation emerged. This system features greater emphasis on individualism and a lesser desire for children. The decline in fertility is viewed as an indicator of progress towards modernity, and thus a positive indicator of the process of transition. This will be referred to as the demographic hypothesis.

2. The decline in fertility is attributed to the economic crisis in general, and the deterioration in income that accompanied transition in particular. Households wanted as many children as before the transition, but they could not afford them because their income had shrunk. The decline in fertility therefore reflects the deterioration in the quality of life and happiness. In other words, it is a strong negative indicator of the process of transition. This will be referred to as the economic hypothesis.

Using preliminary evidence for Russia and Slovenia, Chapter I shows why the economic hypothesis requires in-depth investigation: in Russia, the crude birth rate started

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income and uncertainty) into an analysis of changes in a capability-based welfare indicator (TFR).

to fall in 1986, about 3 years *before* (the proxy for) income started to fall. In Slovenia, the total fertility rate has continued to fall since 1990, while aggregate income has been steadily growing.

To investigate the causes for the rapid fertility decline in Central and Eastern Europe, the thesis uses comparative analysis, econometric tools, theoretical modeling and interdisciplinary approach [**Section 3**]. I show how those tools are used in the different parts of the inquiry.

- Chapter II uses comparative analysis to highlight the essential differences between theories on reproductive behaviour. It shows that there are three approaches to the topic, i.e. economic, sociological and demographic, with each of them talking at cross-purposes. In seeking to bridge the disciplinary gap, it clarifies the hypotheses underlying each approach. The comparative approach helps, in particular, to show the differences between the economic and demographic conceptions of reproductive behaviour.

- Chapter III and IV test the demographic and economic hypotheses of the rapid fertility decline. Russian time-series fertility data are used to explore the behaviour of fertility over long periods of time; and Russian cross-regional fertility and income data are used to explore possible explanatory factors.

- These two chapters make use of econometric techniques. Stochastic (unit root) analysis is used to study the behaviour of fertility data over time; structural break analysis is used to detect an abrupt change in the evolution of the fertility trend over time; and standard linear regression technique is applied to regional data.

- I discuss the sources of information, their diversity and the originality of data. The inquiry is based on official Russian regional and time-series fertility data (Goskomstat) and more sophisticated demographic information (Centre for Human Ecology and Demography and Institut National d'Etudes Démographiques). I obtained economic and demographic data for countries of the Central and Eastern European region from the Economic Commission for Europe and the International Child Development Centre.

- In a preliminary attempt to model 'people's perception of uncertainty', chapter V shows how the 'lack of confidence in tomorrow' can lead a household to postpone having an additional child to a later date.

- This thesis is deliberately interdisciplinary. Indeed, one of my earliest findings has been that the absence of such a broad approach is handicapping progress in understanding development in this field. In reality, reproductive decisions are likely to be influenced by a complex series of contextual forces: economic, social, cultural, educational and political, as well as personal circumstances. These factors are neither fully independent of each other nor mutually exclusive: they overlap and interact. In using an interdisciplinary approach, I shed some light on the benefits of a broader approach to the topic.

Chapter II observes that there is no single grand explanation on why and how reproduction changes over time. The field emerges as a collection of quite distinct and often contradictory approaches. Three approaches dominate the topic, i.e. economic, sociological and demographic, with each of them talking at cross-purposes. In an effort to find out the reasons for this disagreement, chapter II contrasts the different approaches and establishes the limitations and strengths in each case.

The first section explores the economic model of reproductive behaviour [**Section 1**]. This model is an application of Rational Choice theory to reproduction. Rational Choice theory is characterized, using the following questions: what is the object of choice? What structures this choice? What principle leads to this choice? In economics, the object of choice is a commodity bundle – the outcome of an individual choice. This choice is structured by an ordering of those bundles in an internally consistent way (the concept of perfect rationality), by a budget constraint, and often by a numerical utility function. The choice between commodity bundles is driven by an optimization behaviour.

I focus on Becker's contribution to the field. His theory emerges as a special version of the consumer choice theory: individuals (or households) are assumed to solve their problems, say, in terms of choosing a family size, by choosing a bundle of children and goods, given the budget constraint, which maximizes utility.

Using this framework, the economic determinants of reproductive decisions are: (1) the price of children relative to other commodities (quality of children and opportunity cost of time); (2) individual income; and (3) 'other constraints' (for example, availability and cost of contraceptive techniques and provision of housing).

I formally present Becker's model of reproductive behaviour. The model embodies the standard behavioural assumptions of Rational Choice theory. The determinants of reproductive decisions are the costs of children and income—other constraints like technology are held constant. The model treats each household as a unit of analysis and children as "consumption goods". I show that reproductive decisions result from two effects (in the Slutzky sense): (1) a positive income effect, and (2) a negative substitution effect.

I then investigate two possible extensions of Becker's model. The first extension introduces an inter-temporal dimension to reproductive decisions. I briefly discuss two models: the 'fertility cycle hypothesis' of Easterlin in which fertility and the economy are linked in a perpetual series of fluctuations, powered by income expectations, alternation of cohort size, and autonomous cycles in the economy itself; and the altruistic model of Barro and Becker. The latter model assumes that individuals are well informed and adopt a perfectly rational, forward-looking behaviour in making their decisions. As I will argue in chapter V, this assumption is unsatisfactory in a context of broad uncertainty.

The second extension considers the collective dimension of reproductive decisions. *Individual* fertility decisions may not be *socially* optimal under two circumstances: (1) the presence of externalities, and (2) 'wrong' relative prices of goods and services due to imperfections in the market for children.

The second section studies the prevailing sociological paradigm, comparing it with the economic paradigm [**Section 2**]. In general, economists value the contributions of sociologists in the field of reproductive behaviour: sociologists may adopt different methods than those economists are used to, but the concepts underlying their investigation, such as choice in human action and rationality, are very similar. In some respects, it can be argued that there is no essential contradiction between the two paradigms, only a difference in emphasis.

I characterize the prevailing sociological paradigm using three questions: what is the object of choice? What structures this choice? What principle leads to this choice? In sociology, the object of choice is an idea about the desirable number of children (or ideal family size) –the outcome of a social choice. The ideal family size is constrained by attitudes (or tastes) towards reproduction. These attitudes are shaped by 'norms and values' and are internalized by individuals in the process of socialization. The dynamics of social behaviour is described as a process that leads either to an optimum or to a weaker form, satisfaction.

I illustrate some of these aspects by looking at institutional theories of reproduction. These theories attribute a primary role to socio-economic conditions in the process of formation of 'norms' and the 'ideal' family size. Each individual is said to be, in any society, under strong constraints regarding reproduction. These constraints are set by the institutional structure of every society, that defines, among others, the 'rewards' of having a child, and how much couples must 'sacrifice' to have children.

The third section explores the model of a sub-group of demographers, the proponents of the deterministic model of fertility change **[Section 3]**. I call them 'classical demographers' and distinguish them from 'modern' demographers that support socio-demographic theories of fertility change. I choose to focus on 'classical' demography for it reveals the essential differences between the demographic and economic conceptions of human behaviour.

I highlight the disagreement that exists between demographers and economists. On the whole, economists look at the contribution of demographers the field of reproductive behaviour with mixed feelings. In an effort to find out the reasons for this disagreement, I clarify the hypotheses underlying each paradigm.

My findings can be summarized as follows:

1. Demography assumes that each society converges towards an equilibrium. Economics embodies the concept of equilibrium, but not exclusively: it allows for no-equilibrium situations to arise.

2. Demography assumes that this equilibrium is unique, while economics allows for multiple equilibria to emerge as well.

3. Demography assumes that the mechanism that drives each society towards this equilibrium is beyond its control. In particular, fertility behaviour is pre-determined. In contrast, economics responds to the idea of 'voluntarism' on behalf of individuals.

I analyze the demographic paradigm using three questions: what is the object of choice? What structures this choice? What principle leads to this choice? It is understood from the discussion above that the term 'choice' is used loosely here. In demography, there is no object of choice: there is no fertility decision to make either by individuals, or society. Reproduction is constrained by superior laws of Nature; it results from two inter-linked processes: the "struggle for existence" and the Darwinian selection process.

I contrast further the prevailing economic and demographic paradigms by showing that demography is primarily interested in long-term trends in the fertility rate. In contrast, economics makes relatively fewer assumptions about long-term equilibrium relationships: it is primarily concerned with short-term fluctuations in the fertility rate. I conclude that the demographic paradigm does not simply differ from the economic paradigm in its approach to study reproductive behaviour; it makes up for an entirely distinct paradigm.

Finally, I illustrate the scope of the demographic paradigm by looking at the 'Demographic Transition Hypothesis'. This hypothesis states that each society experiences an 'adaptation' towards a given equilibrium fertility level. This equilibrium level is unique and theoretical: as chapter III will argue, demographers never observed this equilibrium level, but only detected the presence of a long-term trend towards that equilibrium.

I explain why demographers view the decline in fertility, an irreversible feature of the adaptation process, as a positive long-term indicator of development. For demographers, the decline in fertility: (1) features only 'modern' societies; (2) it reflects 'increased rationality' on behalf of agents who make the decision; and (3) it is associated with the desirable prospect of 'Westernization' and adoption of 'Western values and attitudes'. Although attractive by its simplicity, the 'Demographic Transition Hypothesis' is frequently in dispute with factual evidence.

Chapter III develops and tests the demographic hypothesis of the fertility decline. It begins with the observation that there is no grand demographic theory on the fertility

decline in transition Europe, but only fragmented pieces of explanations that emphasize the role of 'adaptation' towards Western fertility levels [**Section 1**]. The purpose of this chapter is twofold: first, to derive a consistent demographic hypothesis of the fertility decline in Russia; and second, to test this hypothesis on Russian time-series fertility data.

To formulate such a hypothesis, I make use of two central, theoretical concepts in demography: adaptation and shifts in the timing of births. The first concept refers to the process by which each society progresses from a high fertility level towards a low fertility level. The second concept concerns the decision on the timing of birth. Demography assumes that parents can shift (bring forward or postpone) the birth of a child in response to a change in the environment in which they live.

These concepts are then used to formulate the demographic hypothesis on the fertility decline in Russia.

- Leading Russian demographers believe that 'adaptation' has been underway since the end of the 1950s in Russia.

- I assume that transition was similar to a large social shock to the population: it accelerated the 'adaptation' process—the so-called catching-up effect. With the opening of borders, the East has been adopting the Western system of values and attitudes. This system promotes greater individualism and a lower desire for children.

- Even if there was a large social shock, the attitudes towards reproduction cannot have radically changed overnight. I find an additional factor to account for the sharpness of the decline in the history of the country. In the mid-1980s, the Russian government introduced pro-natalist policies. The immediate effect was to reduce the interval between successive births, while leaving reproductive intentions unchanged. In this framework, the current fertility decline is nothing else than a return to the 'normal' fertility level—the lagged-effect of pro-natalist policies.

I translate this hypothesis into statistical concepts that can be applied to actual data. To establish such a link, I make two assumptions.

1. I assume that the long-term fertility trend reflects fundamental attitudes towards reproduction. Thus, a change in attitudes can be detected whenever a new fertility trend emerges. To detect this new trend, I use structural break analysis.

2. Fluctuations in fertility data around the fertility trend reflect shifts in the timing of births. I compare the behaviour of fertility with output in the business cycle. I assume that fertility behaves in a similar way: like output, fertility follows a long-term trend and fluctuates around that trend. To test this model, I use stochastic (unit root) analysis.

The first part of the testing procedure concerns 'changes in attitudes' [**Section 2**]. After exploring the benefits of structural break analysis to detect sharp changes in trends, I apply the technique to time-series fertility data. I find two significant structural breaks in the fertility trend: 1989 and 1992. To assess the comparative importance of these breaks I run a third regression that contains both of them. I find that the 1989 structural break is the only significant one. Thus, (the slope of) the fertility trend broke in 1989, suggesting an attitudinal change towards reproduction around that time.

In the second part, I test the full demographic hypothesis—the existence of an attitudinal change and shift in the timing of births [**Section 3**]. Two models are defined to represent fertility data over time. The first model assumes that fertility data behaves randomly over time (stochastic model). The second model assumes that fertility data behave in a 'predictable' way over time. In particular, fertility follows a long-term trend, with a structural break in 1989 and fluctuates around that trend. The second model is the (approximate) statistical representation of the demographic hypothesis.

Using stochastic (unit root) techniques, I test whether fertility data follow a stochastic behaviour (model 1) against the alternative of a deterministic trend with a structural break in 1989 (model 2, the demographic hypothesis). The data set consists of the Russian Total fertility rate (TFR) and the age-adjusted fertility rate time-series (1960-95).

The findings can be summarized as follows:

1. There is insufficient evidence for the demographic hypothesis. Specifically, I cannot reject the stochastic model for almost all fertility series (except two age-adjusted fertility time series). This means that fertility data behave randomly; they cannot simply be represented by a long-term breaking deterministic trend with fluctuations around that trend. I am in the presence of a highly complex phenomenon.

2. Two age-adjusted fertility series (for women between 20 and 24 and below 24) follow a distinct pattern. For these two series, I can reject the stochastic model. Thus, fertility data do not behave completely randomly. This is as far as I can conclude from this finding. In particular, I cannot infer that these series follow therefore a 'deterministic (breaking) trend' model, and I cannot tell what is the appropriate statistical model for these series.

Finally, I discuss the limits of the testing procedure. First, I argue that the method, constrained by the current knowledge in econometrics, only imperfectly tested the demographic hypothesis as initially stated. In particular, I could not test, specifically, whether the current fertility decline resulted from the historical lagged effect of pro-natalist policies in the 1980s. I only tested the much broader idea of reversion to a deterministic trend (or cyclical fluctuations). Second, I examine the extent to which the appropriate procedure was used to test the demographic hypothesis. In an ideal world, it would have been more satisfactory to test the representation of the demographic hypothesis (model 2, deterministic breaking trend), against the stochastic model (model 1), and not the inverse. However, this procedure was constrained by techniques presently available in econometrics: it is yet technically impossible to test the deterministic breaking trend model, against the stochastic model.

Chapter IV explores the economic hypothesis of the fertility decline. The first section investigates the regional dimension of the rapid fertility decline, by using Russian regional fertility data (total, rural and urban fertility rates) [**Section 1**]. I make the following findings: (1) the TFR collapsed across all regions of Russia. (2) The fertility rate change hides large intra-regional differences. While both the urban and the rural fertility rates collapsed, the urban fertility rate appears to have fallen slightly more. (3) There is a striking uniformity in the rate of urban fertility decline: it fell by 30 percent across all regions of Russia between 1990 and 1995.

The second section explores theory and evidence on the connection between income and fertility changes [**Section 2**]. I argue that Becker's theory of reproductive behaviour by itself cannot predict whether the effect of a lower income will be, on balance, to lower or higher fertility. In fact, Becker predicts that income-produced forces act on fertility in opposite directions: whenever tastes and values are fixed, an increase in income should be translated into a *rise* in fertility—the pure income effect. However, in some circumstances, an increase in income might be translated into a *decrease* in fertility. I show that empirical evidence on the effect of changes in income on fertility have been hitherto mixed.

I derive the implications of this discussion for testing purposes. To minimize the effect of changes in 'tastes' during the period explored, I choose the period *after* the structural break in the fertility trend, i.e. the 1990-95 period.

The third section describes problems related to the measurement of income in Russia, and suggests some solutions [**Section 3**]. In transition Europe in general, and Russia in particular, *individual* income figures are largely unreliable, and it may be easier to work with *aggregate* data. I discuss whether, in Russia, aggregate income data are a good proxy for individual income. I suggest that, at worst, using aggregate income data will under-estimate the fall in individual income of those at the bottom of the income-scale.

To proxy the change in income in Russia, I choose the (change in the) volume of industrial production. The choice of this proxy can be justified, in the specific context of Russia, on the grounds that: 1) aggregate income, and its equivalent in the National Accounting sense, the total value of output (GNP) are unreliable indicators of activity, and 2) nominal measures of production are undesirable in a country that experienced hyper-inflation. As a result, I choose the physical (volume of) industrial production to proxy regional output. I use the year-to-year change in the proxy to neutralize the effects of *systematic* under-reporting problems.

In anticipation of Chapter V, a second explanatory variable is introduced in the analysis: (a proxy for) 'people's perception of uncertainty'. Intuitively, uncertainty is likely to affect the *perception* of current and future job opportunities and enhances the fear for the future (the lack of confidence in tomorrow). To proxy for 'people's perception of uncertainty', I use the Labour Force Survey unemployment rate in 1994. I show that it is significantly related to the (change in) total fertility rate for the 66 regions

of Russia. The presence of unemployment rates similar to those in Western Europe suggests that the level of uncertainty is identical in Western Europe as in Eastern Europe. This is clearly not the case: uncertainty is much broader in Eastern Europe. Thus, the unemployment rate is likely to be an imperfect, crude measure of uncertainty.

The fourth section turns to the specification of the regression model and the interpretation of findings **[Section 4]**. Using Goskomstat and Labour Force Survey (LFS) data for 66 regions of Russia, I explore the relationship between the (average annual) change in the volume of industrial production (a proxy for income), $\Delta IP_{90\text{-}95}$, and the (average annual) change in the fertility rate between 1990 and 1995. I define a dummy, DUM2, to account for 12 regions that are characterized by a 'large' fall in industrial production. I use the LFS unemployment rate in 1994 to proxy for 'people's perception of uncertainty'. The control for inter-regional disparities between rural and urban areas is done with a "modernization" variable, URBAN95 (share of urban population in the total population in 1995). The Regions of Moscow and St Petersburg are isolated into a dummy (METROP). The dependent variable is the fertility rate (total, urban and rural).

Before I examine the set of results, I observe that, on conventional econometric grounds, (the proxy for) income, $\Delta IP_{90\text{-}95}$ (and DUM2), is only slightly significant and could be rejected as an explanatory variable.

The findings can be summarized as follows:

1. There is a pattern with regard to the total fertility rate: regions with the largest change in the total fertility rate suffered from the largest change in (the proxy for) income. The positive relationship between income and fertility holds across regions. I also find (the proxy for) regional disparity in uncertainty, $UNEMP_{94}$ to be significant. This is a striking result. It shows that it is the combination, and not the unique effect of income, with uncertainty that can explain regional disparities in the TFR change. As expected, the metropolitan regions (Moscow and St Petersburg) follow a specific pattern; and the control for urban-rural inter-regional differences is significant.

2. A similar pattern exists for the urban fertility rate: regions with the largest fall in the urban fertility rate experienced the largest fall in (proxy for) income and higher uncertainty.

3. The (proxies for) income and uncertainty fail to jointly explain the change in the rural fertility rate. The rural fertility rate appears to have only responded to the fall in income, and not uncertainty. I then discuss whether this result indicates that uncertainty played no role in the fertility decline of rural areas. I conclude that further investigation is required in this area, notably in developing a better indicator of uncertainty.

To sum up, this chapter challenged the simple economic model of reproductive decisions where fertility fell in response to the deterioration in living standards, and suggested an additional connection with uncertainty. The deterioration in material wellbeing explained in part, the rapid fertility decline: the rise in (the proxy for) uncertainty contributed to explain it as well.

Chapter V reconciles the standard economic model of reproductive behaviour with my findings by building a simple model. The first section shows that transition Europe features 'broad uncertainty' **[Section 1]**. Individuals have to make decisions in an environment characterized by institutional, prices and income uncertainties. The presence of broad uncertainty enhances the complexity of individual decision-making.

The second section examines the standard model of economic behaviour under uncertainty **[Section 2]**. It shows that the presence of uncertainty poses a challenge the standard behavioural assumptions of economic theory:

- Completeness of Information. Uncertainty affects the capacity of individuals to *know about* 'what state of the world' will prevail; individuals do not have all the necessary information to make probability judgements.

- Perfect Rationality. In the presence of uncertainty, individuals may be unable to process all available information in a consistent way. In a static decision-making context, preferences of agents may fail to be internally consistent. In a dynamic context, individuals may be unable to adopt rational expectations (or a forward-looking behaviour). In particular, one can reasonably expect that the individual will depart from perfect rationality in an environment where information (and its update) becomes problematic, and patterns of economic behaviour are not well settled in times.

- Optimization Behaviour. Under uncertainty, individuals may not necessarily look for utility 'maximization'. Depending on the decision rule adopted, different first-best outcomes may emerge.

To sum up, decision-making under broad uncertainty is a highly complex phenomenon; it cannot be confined to an informational problem.

The third section develops a simple economic model of reproductive decision, where households lack confidence in tomorrow **[Section 3]**. In this model, each household can choose between having a child now, or having it later. This decision has to be made in an extremely unpredictable (or broadly uncertain) environment. I assume that broad uncertainty impedes the household's capacity to 'rationally' process information: it perceives that the cost of having a child *now* is 'overly high' compared to having it *tomorrow*. This extra cost proxies for the lack of confidence in tomorrow. The model shows that the household will postpone the task until tomorrow. If replicated over a large number of households, the individual decision to procrastinate entails an aggregate short-term fall in the fertility rate.

In the model, each household is treated as a unit of analysis. Moreover, I make the following assumptions: (1) the decision concerns the incremental child, (2) each household has to make a decision every period, (3) the benefits of an additional child is fixed, (4) the costs of having a child include the direct cost of rearing a child and the opportunity cost (foregone wage).

Reproducing Akerlof's model (1991), I formally decompose the decision-making process. The model allows for the following outcomes:

1. Every period, each household postpones the decision of having an additional child. This decision arises from the presence of broad uncertainty: it causes the cost of having a child now to be unduly salient in comparison with future costs. If replicated over a large number of households, the individual decision to procrastinate entails an aggregate short-term fall in the fertility rate.

2. In some circumstances, the final outcome may be a definite suspension of childbearing.

I conclude the section by discussing the 'perfect rationality' assumption. Was the individual decision to procrastinate 'rational'? In the model, I assumed that broad uncertainty impeded households' capacity to both maximize over the long-term and being rational over that time horizon. The relaxation of the Rational Expectations (forward-looking behaviour) assumption led them to decide not to have children now.

It could, however, be argued that procrastination *was* a perfectly rational decision. I suggest two alternative hypotheses: the asymmetric cost hypothesis and the information overload hypothesis.

Finally, I explore the apparent income-fertility dilemma in transition Europe [**Section 4**]. On the one hand, the fall in income explains the rapid fall in the fertility rate in Russia. On the other hand, income recovered in most countries of Central Europe; but the fertility rate has not turned around. This is, for example, the case in Slovenia, Poland and the Czech Republic.

The Slovenian case is consistent with the Russian evidence (and in particular, the *positive* income-fertility relationship) provided that a second explanatory variable, 'people's perception of uncertainty', is accounted for. Although some countries in Central Europe recovered from the initial reforms, people may still *perceive* that uncertainty is high and show a generalized lack of confidence in tomorrow. The effect of people's perception of uncertainty on reproductive decisions can be so strong that it outweighs the benefits from increased income.

2. Policy Conclusions

The decline in the total fertility rate was initially perceived as transitory. But, recent figures indicate that fertility declines and stabilization around a low fertility level are on the verge of becoming endemic to transition Europe. This situation raises three interesting policy questions: first, can anything be done to reverse this decline; second, should anything be done; and third, if so, what can be done about it.

2.1. Can anything be done?

The extent to which fertility decline can be reversed brings us back to the fundamental difference between the economic and the demographic conceptions of reproductive behaviour (Chapter II). For economists, reproductive behaviour is a matter of individual and conscious choice. As such, the fertility decline can be influenced by adequate incentives and can be easily reversed[139]. In contrast, for 'classical' demographers, fertility behaviour is constrained by laws of Nature that dictate to society and individuals the equilibrium fertility level (ideal number of children). Low level of fertility is an inherent feature of modern Western life, and its decline is largely irreversible.

2.2. Should anything be done?

Two distinct visions on whether anything should be done ensue from this comparison. For 'classical' demographers, the decline in fertility is largely a positive indicator of development. The sharp fertility decline in Central and Eastern Europe results from a process of accelerated adaptation towards a modern, Western life: there is no 'fertility crisis' and nothing should be done about it[140]. In contrast, for economists, the fertility decline is a strong negative indicator of development. The sharp fertility decline in Central Europe reflects the deterioration in the quality of life and happiness. To sum up, there is a 'fertility crisis' in transition Europe, and something should be done about it (Chapter IV).

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[139] The effect of tax benefits on the timing of births has been recently explored by Dickert-Conlin and Chandra, 1999.

[140] As argued in Chapter I, this is a simplified interpretation of the demographic model. In fact, demographers are concerned by fertility declines in transition Europe (and refer to a fertility crisis) for the changes in the TFR were sharp and the subsequent level is below replacement.

2.3. What can be done?

The policy conclusions that are presented here are partial for two reasons:

1. Although the thesis attempted to incorporate a number of explanatory factors, it had to concentrate on a few of them for empirical testing. In particular, this inquiry ignored particular factors, such as personal circumstances or educational differences that may have been important explanatory factors as well.

2. Moreover, the conclusions are based on Russian evidence. It was hoped that Russia would be a sufficiently representative case of the entire Central and Eastern European region. Further country-specific studies are however required to confirm this point.

This investigation provided evidence that the rapid decline in fertility is a highly complex phenomenon:

- In part, the Russian fertility decline reflects an adaptation of family patterns towards the modern, Western system of values and attitudes. Thus, it is a positive indicator of development for Central and Eastern European societies.

- But, most of the cross-sectional evidence suggested that fertility declines represented the individual response to lower income and higher uncertainty (insecurity); and thus, a strong negative development indicator for Central and Eastern Europe.

Based on these findings, the policy-makers of Central and Eastern Europe should be concerned with the rapid fertility decline, for it largely represents frustrations, unhappiness and deterioration in the quality of life subsequent to transition. In order to reverse the fertility decline in transition Europe, 'successful reforms' have to be rapidly achieved. In particular, the following specific policy suggestions emerge as palliatives, although important ones, if the fertility decline is to end sooner rather than later:

1. Strong and rapid recovery of the individual income is a priority for the entire region;

2. Provision of an adequate social safety net is needed to stabilize individual income and minimize the uncertainty surrounding income. This is particularly important during the period of rapid economic and political transformation those countries are presently undergoing.

3. After the turmoil of the first years of reforms, economic and political 'stabilization' is needed in the region. Stabilization should help reverse the generalized lack of confidence in tomorrow that has characterized the transition period.

Moreover, the rapid recovery of the total fertility rate is particularly important in view of the present ageing population trend. In the absence of a rapid fertility recovery, Central and Eastern European countries are likely to experience an exacerbated 'old age crisis', whereby the rapidly shrinking younger population will have to provide for the growing proportion of older people. There is a risk that the financial burden imposed by such a trend becomes rapidly unsustainable.

3. Further Work

This investigation opened a range of new questions. It also showed the limits of our current understanding of what emerges as an important subject of investigation. This section suggests some avenues worth pursuing in this area.

3.1. Economic Theory of Reproductive Behaviour

The standard economic model of reproductive behaviour should be extended to encompass 'people's perception of uncertainty'. This inquiry used empirical evidence and examples to show its importance in reproductive decisions.

More broadly, the standard behavioural assumptions of Rational Choice theory are difficult to reconcile with the presence of uncertainty. Rational Choice theory adopts a narrow view of the effect of uncertainty on individual behaviour: it often confines uncertainty to an informational problem, while it clearly goes beyond that problem. There is a need to broaden the prevailing economic paradigm.

Economic theory relies heavily on the rationality assumption. Even Becker in his Nobel Prize lecture (1996) recognizes that "(his) work may have sometimes assumed too much rationality"[141]. Unfortunately, "the deficiencies in the 'rational actor' model have long been recognized... economists have defended their pursuit of the rational actor model on the grounds that it was the best game in town: it gave well-defined (refutable, and, unfortunately, refuted) predictions, while the alternative was a Pandora's box—there was an infinity of possible irrational behaviours" (Stiglitz 1991)[142]. This is, however, to forget that economists must study how individuals actually behave, whether that behaviour conforms to rationality or not.

Some economists have recently set a new direction of analysis. In a variety of papers that I explored, Akerlof showed that, if individual behaviour is not rational (in the economic sense), it does not mean that it is not predictable. Incorporating this dimension into the economic theory of reproductive behaviour, as I started to do, can help

[141] Becker pursues "but I believe it has been an antidote to the extensive research that does not credit people with enough rationality".
[142] Stiglitz (1991) pursues: "The economists of the twentieth century, by pushing the neoclassical model to its logical conclusions, and thereby illuminating the absurdities of the world which they had created, have made an invaluable contribution to the economics of the coming century: they have set the agenda, work on which has already begun."

understand certain fertility patterns that cannot be presently explained (for example, the rapid fertility decline in Slovenia).

3.2. Testable Hypotheses

Economic and demographic theories of fertility changes should provide testable hypotheses. At present, Becker's economic theory of reproductive behaviour cannot be falsified; the 'Demographic Transition Hypothesis' was never validated empirically. The theoretical relationships that emerge from these frameworks are so broad that they can be reconciled with any findings. As a result, none of these theories is able to predict reproductive patterns.

3.3. Interdisciplinary Focus

Using an interdisciplinary approach to understand reproductive behaviour is highly desirable. Each discipline can learn a lot from one another. Even a discipline like macroeconomics can give insight into this area. For example, I used stochastic (unit root) analysis usually applied to analyze macroeconomic GNP time-series and explored how their application to demographic data could improve our understanding of reproductive behaviour.

3.4. Econometric Approach

Econometrics provides powerful tools to test alternative hypotheses on data. I, however, showed the limits of our present state of knowledge. Even the most advanced econometric tools are not strong enough to discriminate among fundamental different hypotheses. For example, as chapter IV showed, stochastic econometric techniques allow to test one type of model (stochastic trend), against another (deterministic trend), but not the inverse. Efforts to develop these tools should help to analyze data and improve our understanding of observed behaviour.

Econometric techniques can be useful to improve short-term forecasts and long-term projections of the total fertility rate. Under our present state of knowledge, the trajectory of the total fertility rate cannot be predicted. This area deserves further investigation, particularly in regard to its importance for policy purposes. For example, reliable forecasts of the fertility rate for the next 10 years should help project future needs in the health care, education and housing sectors, and thereby their provision.

3.5. Measurement of People's Perception of Uncertainty

Probably the most original finding of this investigation has been that 'people's perception of uncertainty' matters in reproductive decisions. To test the explanatory power of uncertainty, I used cross-regional data of Russia. But the proxy that I used, the Labour Force Unemployment rate, was clearly an imperfect and crude measure of uncertainty (although readily available). There is scope to develop a refined indicator of uncertainty.

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