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# Employment Instability and Fertility Timing in France: An Application of Turbulence to Labor Market Trajectories

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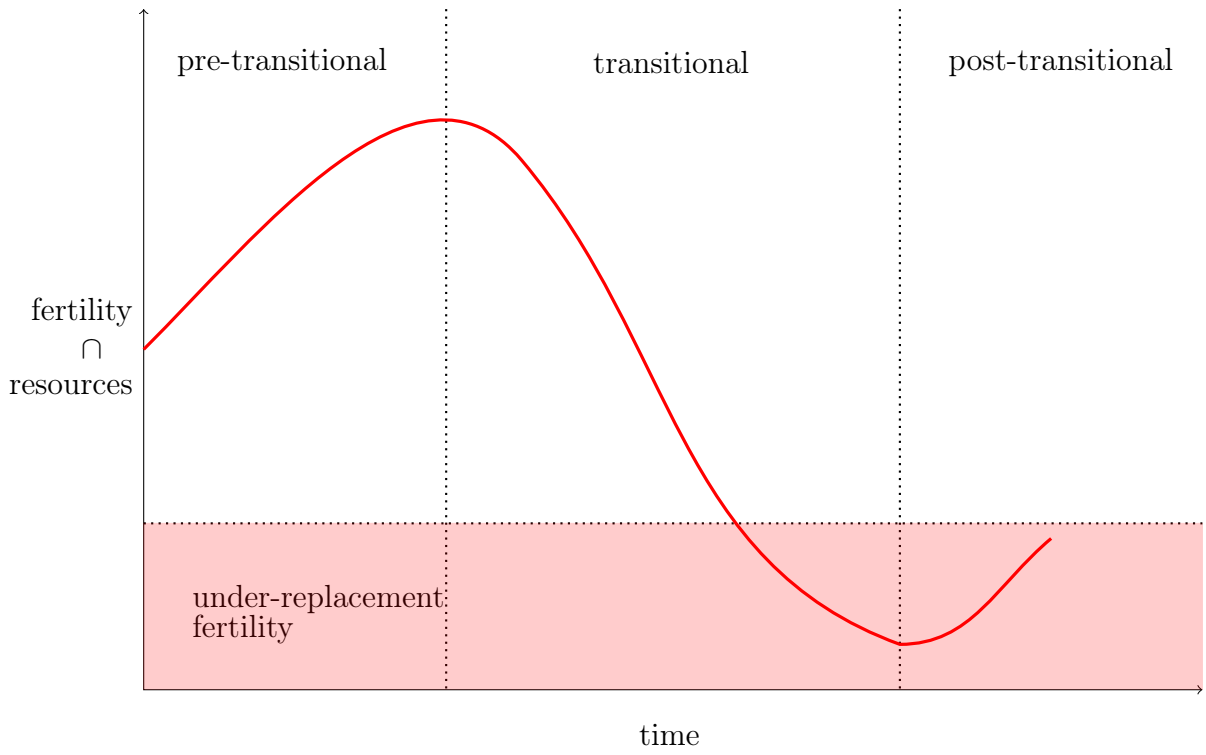
# Contents

# 1 Introduction

Figure 1 presents a description of the evolution of the relationship between fertility and living standards in Europe, in which it is possible to identify three different regimes: ① A *pre-transitional* regime, characterized by high fertility rates and a positive association between reproductive behavior and living standards. ② A *transitional* regime, when the association becomes negative as countries experience sustained economic development at the same time that families become smaller and smaller, and ③ a *post-transitional* regime, in which the relationship becomes positive again and countries with higher living standards start showing a relatively higher number of children per woman.

Figure 1: Evolution of the Macro-level Relationship Between Living Standard and Fertility




Source: own elaboration

Malthus (1888) was the first to provide a detailed account of the pre-transitional regime, as one in which the constant fluctuation of mortality and fertility was a direct response to variation in economic conditions. In fact, Malthus viewed the ability to buffer the effects of economic hardship through fertility reductions, which he called the *preventive check*, as one of the key characteristics of pre-industrial western societies and as one of the explanations of the relative higher wealth level of European countries. These fertility adjustments operated via postponed marriages when times were uncertain.

Hajnal (1965) further elaborated on this idea, providing an exhaustive description of the *Western European Marriage Pattern*, a system in which only those who achieved a position stable enough to provide for a family had the option to marry.

However, historical evidence suggests that the effects of economic stress were not entirely channeled through nuptiality. Using pre-transitional micro level data from Europe and Asia Tsuya et al. (2010) have shown how those in a less advantaged economic position had both increased chances to remain single and lower probabilities of having additional children. In fact, among historical demographers is a well-established fact that pre-industrial households responded to changes in food prices by adjusting their fertility, a response that in most cases was more pronounced than those of mortality or nuptiality. Bengtsson and Dribe (2010) showed, for example, how these variations were the result of deliberate actions of couples, who decided to adjust their fertility in the face (or in prevision) of hard economic times.

During the demographic transition, household's fertility decisions were probably not completely unconstrained by economic conditions, but in a context of simultaneous fertility decline and rapid improvements in living standards the discussion about fertility determinants was dominated by arguments based on ideational change hypotheses.

In fact, this relatively long period of economic growth that accompanied the significant population growth experienced in industrialized countries during the demographic transition, was interpreted as a clear sign of a new stage, were Malthusian principles did no longer apply. A period where the trend was towards an increasing disconnection between economic and population processes. As Bengtsson and Saito put it:

> At the very least, short-term uncertainty in pre-industrial society made individuals' and households' long-term plans, such as those for old age, more difficult to carry out. When population and resources grew our of balance, either because per-capita real income declined in a steady and sustained fashion or because families grew in size, the short term uncertainty problem became even more critical. The rise of the modern industrial economy eventually removed such uncertainties. Families became less concerned with planning for day-to-day survival, and relatively more concerned with strategies for improving their standard of living over the long term (Bengtsson and Saito, 2000, p. 12).

To understand the negative sign of the relationship between economic prosperity and fertility, neoclassical models introduced the idea of a trade-off between the quantity and quality of children. The theory argued that as income increases, the demand for child *quality* (the time and resources invested in each child) increases at a faster rate than the demand for a larger number of children (Becker, 1981).

The theory of the Second Demographic Transition (SDT) also offered an explanation, which would become very popular, for the role of rising living standards on the steady fertility decline that took most European countries to under replacement fertility levels by the end of the 20$^{th}$ century. The theory claimed that declining fertility and increased partnership instability were primarily driven by the emergence of post-material values (egalitarianism, personal freedom of choice, self-fulfillment) and the receding influence of traditional institutions on individuals (Lesthaeghe and Van de Kaa, 1986).

The duration and strength of the correlation between economic development and low fertility made it 'one of the most solidly established and generally accepted empirical regularities in the social sciences'(Myrskylä et al., 2009).

Recently observed trends, however, have decisively challenged this notion, suggesting the emergence of a new, *post-transitional* regime in Europe. Myrskylä et al. (2009) made the strongest, most explicit case for the regime-change hypothesis, showing how the historically negative correlation between development and fertility becomes positive after countries exceed a certain threshold of human development. In this view, the relatively higher fertility rates in most developed countries reflect basically their capacity to improve the well-being of citizens and their persistent movement towards more egalitarian gender relationships with respect to both paid and unpaid work. These results have been produced in the context of generalized fertility increases, which marked the end of lowest-low fertility (TFR$<$1.3) for most European countries (Goldstein et al., 2009).

This conclusion was also supported by a series of papers published in the early and mid 2000s that showed how the correlation between women's labor force participation and fertility rates across countries has also reverted, and how those countries with a higher share of women in the labor force were also the countries with higher fertility rates (Ahn and Mira, 2001; Adsera, 2004; Kohler et al., 2002).

The question remains, however, whether or not these shifts in macro-level correlations can be also observed at the micro-level. A question that has no clear answer so far. Although some results suggest that the recent increase in fertility rates has been lead by most educated women and men (Caltabiano et al., 2009; Kravdal and Rindfuss, 2008), an extensive meta-analysis of micro level studies on women's employment and fertility has indicated that this is not yet the case. However, the strength of the relationship has shown to be weaker in countries where the male breadwinner model is less predominant (Matysiak and Vignoli, 2008).

Bongaarts and Sobotka (2012), on the other hand, argue that the recently observed

rise in period fertility indicators is entirely a product of the end of the postponement transitions and that fertility quantum in Europe has been stable for the last two decades, which they argue does not imply that material conditions or policy changes are irrelevant, but that they might be influencing *timing* rather than *quantum*.

In sum these developments provide support for the hypothesis of the emergence of a new regime, one in which constraints rather than preferences seem to be the key to understand young couples' family formation decisions in most European countries.

In this context, the notion of *uncertainty* has made a come back. Although initially associated to the rapid fertility decline observed in transitional economies after the fall of the Soviet Union, the economic downturn in most European countries has stimulated the spread the use of economic constraints as one of the relevant factors to understand family dynamics in the region (Kreyenfeld et al., 2012).

Some scholars have pointed to the flexibilization of labour markets as one of the main drivers of the increasing uncertainty levels that seem to characterize the early life course of today's youth (Blossfield, 2005). In fact, young workers are over represented among those with precarious contracts and the unemployed, and have experienced the greater income losses as inequality increased in OECD countries in the last decades (Esping-Andersen, 2009).

# 2 Literature Review

## 2.1 Labor market reform and the de-standardization of the life course

That the sequence of events that comprise individual biographies in contemporary societies has become less stable, less orderly, more complex and less collectively determined is one of the most agreed upon ideas among life course researchers. Behind this notion is the idea that 'traditional' biographies used to be significantly more stable, both in relation to work and family dynamics; a stability guaranteed by the action of strong collective institutions.

However, in the long run, this ideal type against which contemporary trajectories are measured was only dominant for a relatively short period of time (Brückner and Mayer, 2005). In fact, Fussell (2006) has shown how in the case of the United States the life course became more standardized during the first half of the 20th century, thanks to the

expansion of primary and secondary education and the regulation of the labor market. After a couple decades (from the fifties to the seventies) of high institutionalization and standardization, individual biographies started to resemble less and less one another. This increased heterogeneity and complexity was generally interpreted as a result of three major transformations originated in the second half of the 20th century: the expansion of tertiary education, the revolution of women's roles and the emergence of post-material values.

Probably owing to the context of prosperity in which these transformations took place, less attention has been paid to the effects on life trajectories of the changes introduced in labor market regulations since the 1980s. Mills et al. (2006); Blossfield (2005) and Blossfeld (2008) provide notable exceptions, systematically analyzing the effects of flexibilization and deregulation of labor markets on individual trajectories.

The flexibilization of labor markets emerged as a response from governments and companies to increasing external competition in the context of the internationalization of markets and rapid technological change registered in the last decades of the 20th century (Bukodi et al., 2008). Since then, OECD countries have converged to less strict Employment Protection Legislation (EPL), the set of rules governing the hiring and firing process.

The recommendations of the European Commission have favored the implementation of the so-called *flexicurity* approach: a combination of low EPL (to allow for market dynamism) with strong employment security (by means of active employment policies and high unemployment benefits). However, in practice most European countries have introduced labor market flexibility at the margin, easing the limitations for the use of temporary forms of employment, while leaving intact the regulation of permanent contracts. The average share of temporary employment on total dependent work in OECD countries went from 22.4% in 1980 to 39.9% in 2010 (OECD 2004).

The result of unbalanced deregulation has been a deepening of the segmentation of labor markets between the so-called insiders, who held permanent (protected) jobs with higher benefits, and the outsiders, composed mostly by youth and the low skilled, who spend a large fraction of their working life in precarious, unprotected positions.

## 2.2 Economic uncertainty and fertility

As mentioned before, both the shifts on historical demographic changes and the rapid transformations of the labor markets gave strength to the uncertainty hypothesis, with

a series of papers produced in the last decade trying to disentangle the effects of economic uncertainty both at the macro and the micro-level. Until now, the most consistent evidence of a depressing effect has been found using aggregate unemployment rates (Ahn and Mira, 2001; Gutiérrez-Domènech, 2008; Adsera, 2011), although analyses using individual level data have also found significant effects in the same direction.

De la Rica and Iza (2005) argue, for example, that the labour market reform that introduced flexible employment contracts in 1984 is one of the main reasons why ages at first birth in Spain are among the highest in Europe. Significant effects of economic uncertainty on fertility timing have also been found combining 'objective' measures (unemployment, type of contract, income) with 'subjective' measures (self assessment of personal economic situation) (Kreyenfeld, 2005; Philipov et al., 2006).

Vignoli et al. (2012) have demonstrated that taking into account both members of the couple is key to understand the effect of uncertainty on fertility decisions. Analyzing data from Italy they show how stable work contracts are associated with higher fertility, but only when both partners work. This result is in line with the idea that the effects on the timing of motherhood differs not only by gender (Pailhé and Solaz, 2012) but also according to whether women are expected to be caregivers or household providers (Kreyenfeld, 2010).

In spite of renewed interest in the effects of uncertainty on individual decisions, formalizations of the mechanisms involved are still limited. Most studies have adapted Becker's New Home Economics ideas about the effects of income on family dynamics to derive hypothesis on the links between uncertainty and fertility. According to Becker, an increase in household income can produce to opposite effects on the demand for children: an income effect or a substitution effect. An income increase will consequently increase the demand for children, but it also increases children's indirect costs in the form of income and careers opportunities parents have to give up in order to spend time with their children. An income effect is thus observed when the demand for children is positively affected by an increase on income and a substitution effect when the effect is negative.

Since the indirect cost of children are higher for women, who hold most of the childbearing responsibilities, it is likely that the substitution effect will dominate as income increases. Conversely, fertility may likely be increased with a reduction on actual or potential income as a consequence of economic uncertainty. An increase on men's wages, on the other hand, will likely produce an income effect. These hypotheses hold under the assumption of a traditional division of labor within households. In a context where the indirect costs of children are equally distributed, however, the differences between

men and women should be smaller. This last point is becoming central as European countries move towards increased gender equity at a different pace.

## 2.3 Cross country differences: the role of labor market policies

Although most European countries have implemented measures to make the labor markets more flexible, these changes do not automatically translate into increased insecurity for workers. It has been argued that flexibilization and security may not be mutually exclusive when less strict levels of employment protection are combined with active employment strategies and high unemployment benefits like in the case of Denmark or the Netherlands (Bukodi et al., 2008).

Blossfeld (2008) distinguish four different paths countries have followed regarding the combination of EPL strictness and employment sustaining policies: Besides the flexicurity strategy, the *Liberal strategy*, which combines weak EPL and no labor market (LM) policies; the *Insiders Protection strategy*, that combine relatively strict levels of EPL (for insiders) and a high variance regarding LM policies (strong in Sweden, moderate in France and Germany and low in Italy and Spain) and the *Transition countries*, who have kept moderate levels of EPL but weak LM policies.

Along with labor market institutions, school-to-work transitions could also influence the stability of employment trajectories. Highly standardized education systems (like those of Germany or Denmark) increase the probability for labor market entrants to find a first position that is a good fit in terms of skills and vocational preferences.

Another factor that introduces significant variation in the uncertainty-fertility link across countries are differences in gender norms and women's preferences regarding family and careers. For women in male-breadwinner type of arrangements uncertainty regarding employment prospects may not be decisive, on the contrary, in most cases unstable employment trajectories a higher frequency of unemployment or part-time jobs might express the priority given to unpaid work.

## 2.4 The uncertainty-fertility link in France

France represents certainly a challenge for an analysis of the effects of uncertainty on fertility outcomes. Although the French labor market is highly segmented as in most European countries and temporary contracts have increased their share, employment protection regulation is not among the lowest in the country. Moreover France stands

out among its neighbors due to its strong family policy, which eases the difficulties to reconcile family and work most women found in other European countries. According to Toulemont et al. (2008) family policies implemented in the second half of the 20th century is the main reason why fertility rates have remained high in France while most European countries have seen their fertility fall way below replacement level. Pailhé and Solaz's (2012) have also pointed to family policies to explain why the effects of uncertainty on fertility intensity are less notable in France than in other countries.

# 3 Questions and hypotheses

In the following we aim to give answer to two main questions. Here we formulate them and we establish some hypotheses that will guide the interpretation of our results and conclusions

Q.1- Has labor market instability increased over time in France?

H1: We expect labor market trajectories to be more unstable among men and women of younger cohorts, due to the effect of increased unemployment and precarious employment spells.

Q2- What is the effect of employment instability on the timing of fertility in France?

H2: In the case of men we expect unstable employment trajectories to be generally associated with later fertility timing and childlessness. In the case of women we expect the effects to be less strong but equally present when considering the instability experienced *before* the age at first birth.

# 4 Data and Methods

## 4.1 Data

The present study combines exploratory (Sequence Analysis) with confirmatory (Event History) methods to understand the relationship between early life course uncertainty and the intensity of fertility in France. It takes advantage of the recent availability of complete employment histories in the *Etude des relations familiales et intergenerationnelles (ERFI)* a panel survey carried out by INED and INSEE which constitutes the base of the Generations and Gender Survey (GGS) in France. The panel includes 18 to 79 year old metropolitan France residents.

The first wave was carried out in 2005 including 10.079 men and women and is representative of the French population. The second wave consists of 6.534 interviews and due to the high attrition rate is no longer representative, for which the figures obtained with this sample are only valid for the 2005 French population after the application of weights. The survey contains not only detailed information on the reproductive history and fertility intentions of the interviewees, but also complete retrospective and prospective education-employment histories.

## 4.2 Outline of the study

In the first section I use sequence analysis techniques to quantify the degree of instability/uncertainty of employment trajectories. Sequence Analysis consists of a set of techniques originally developed by molecular biologists to find similar DNA patterns, introduced in the social sciences for the first time in the 1980s. These techniques are particularly useful for the study of life-courses because they provide a holistic understanding of individual trajectories, allowing for the combination of multiple dimensions of a biography in one sequence, which becomes the main unit of analysis.

In our case, the education - employment histories will be combined to obtain a unique sequence for each observation in the sample. In ERFI respondents are asked to provide information about the duration of each spell (of at least three months) in which they were: employed, in school, inactive, unemployed, etc. When respondents where simultaneously in two or more states (employed and studying for example), they were asked to choose the activity in which they spent most time. The possible states in the employment/education dimension are:

*Student; Military Service; Employed; Self Employed; Part-Time Employed; Leave; Help at home; Unemployed; Retired; Inactive; Sick; Other.*

After exploring the relevant changes in these trajectories over time I re-classify the sequence-states in order to obtain binary trajectories that represent the transitions from a state of *stability* to one of *instability* and vice versa. The states included in the stable state are: *Student; Military Service; Employed; Self Employed; Leave; Help at home; Retired; Inactive; Sick; Other.* While *Part-Time Employed and Unemployed* comprise the unstable state in the newly obtained sequences.

The proposed scheme should closely represent the experience of uncertainty in men's labor market trajectories. In the case of women, however, it could be argued that a high share of part-time work states are the product of voluntary decisions. In this case there

is a trade-off between losing relevant information and correctly identify instability. Our original criteria was developed having in mind a categorization of women between those that prioritize family and those that prioritize career (for whom part-time employment should be mostly involuntary), although a comparison with a more stringent definition (only unemployment) for women's trajectories is certainly needed.

It could also be argued that being in state "sick" is also imposed, but there is a qualitative difference between the types of mechanisms imposing this state, which is why I decided not to include it with unemployment and part-time. In any case the presence of the state is marginal in our sample (figures provided below).

## 4.3 Definition of Turbulence

In order to measure the degree of instability of trajectories I use the *turbulence* indicator developed by Elzinga and Liefbroer (2007). The concept was borrowed from fluid dynamics were it is used to describe and analyze rapid and irregular change. The definition used here is as follows:

$$T(x) = log_2 \left( \Phi(x) \frac{s_t^2, max(x) + 1}{s_t^2(x) + 1} \right)$$

The advantage of this indicator over similar measures (e.g. entropy) is that it takes into account not only the amount of state-changes in the trajectory ($\Phi$) but also the time spent in each state, the smaller the variance of the time spent at each state ($s_t^2$) the more difficult is to predict in which state the individual is going to be at any particular time, hence the higher the turbulence. $s_t^2, max$ is given by $(n-1)(1-\bar{t})^2$, where $n$ is the length of the sequence and $\bar{t}$ the mean consecutive time spent in each state.

The claim made here is that the turbulence measure obtained from our binary sequences can be interpreted as an indicator of instability in education-employment trajectories. This interpretation is fairly straightforward except in the hypothetical case where a lower turbulence score is the result of individuals spending more than half of the total length of their sequence in states representing *instability* (in this case, part-time and unemployed). The extreme cases being those in which the entire length of the sequence (in this case 348 months) is spent in unemployment or part-time employment. Such cases, however, are very unlikely to be observed (specially a sequence uniquely com-

posed of unemployment spells) and in fact there are no cases of this sort in the sample analyzed here.

Table 1 presents the proportions of individuals at four intervals of time by state and sex. In the case of part-time employment a 98% (of males) and 89% (of females) spend less than 101 months in this state. Although the cases spending more than this time in part-time employment are a minority, in the case of women the figure is large enough to consider a different definition of turbulence (including unemployment spells only). For *unemployment* the figures do not suggest any major issues, the vast majority of individuals (both males and females) spend less than 1/3 of their trajectories unemployed.

Table 1: Proportion of Cases (Sequences) by Time Spent in Selected States

| | Part Time | | Unemployed | |
|---|---|---|---|---|
| | Males | Females | Males | Females |
| [0,20] | 0.92 | 0.68 | 0.90 | 0.84 |
| (20,100] | 0.06 | 0.21 | 0.08 | 0.14 |
| (100,247] | 0.01 | 0.09 | 0.01 | 0.02 |
| (247,347] | 0.01 | 0.01 | 0.00 | 0.00 |

The states in which individuals spend more time are *employed* and *student* as can be seen in Tables 2 and 3. As expected there are few or no retirees in our sample (including up to age 50) and the proportion of time spent *sick* is also marginal in our sample.

Table 2: Proportion of Cases (Sequences) by Time Spent in Selected States

| | Student | | Employed | | Self Employed | | Sick | |
|---|---|---|---|---|---|---|---|---|
| | Males | Females | Males | Females | Males | Females | Males | Females |
| [0,20] | 0.20 | 0.15 | 0.08 | 0.14 | 0.90 | 0.96 | 0.98 | 0.98 |
| (20,100] | 0.71 | 0.73 | 0.17 | 0.31 | 0.05 | 0.03 | 0.02 | 0.01 |
| (100,247] | 0.09 | 0.12 | 0.47 | 0.41 | 0.04 | 0.01 | 0.01 | 0.01 |
| (247,347] | 0.00 | 0.00 | 0.28 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 |

## 4.4 Event History Models

After trajectories are classified according to their level of turbulence the new variable obtained is introduced as a time-varying covariate in an extended Cox Regression model

Table 3: Proportion of Cases (Sequences) by Time Spent in Selected States

| | Leave | | Retired | | Help at Home | | Inactive | |
|---|---|---|---|---|---|---|---|---|
| | Males | Females | Males | Females | Males | Females | Males | Females |
| [0,20] | 1.00 | 0.85 | 1.00 | 1.00 | 0.98 | 0.99 | 0.99 | 0.82 |
| (20,100] | 0.00 | 0.14 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.09 |
| (100,247] | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 |
| (247,347] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |

predicting the timing of first births. Turbulence is computed for each trajectory *prior* to the exact age (months) at first birth and up to age 45 / age censored for those that have not experienced the event. The measure is taken cumulatively at each age (since age 17) and introduced as a binary covariate that identifies those with *high* and *low* turbulence. Given the fairly different distributions of turbulence between men and women (higher in the latter), the cut point for the *high* turbulence group was taken as the median for men and the fourth quartile for women.

Introducing turbulence as a time varying variable allows for the comparison of its levels between those experiencing the event at each failure time and those in the risk set at that particular time.

I present separate models for males and females, both including individuals from age 25 to age 50 given our focus on the labor market changes described in section 2.1, which particularly affect recent cohorts.

In the models we also asses the effect of / control for the following covariates:

* Education of respondents | Fixed | in three categories: Low -primary and first cycle secondary, Medium - second cycle secondary, High - Tertiary.

* Timing of first union formation | Time varying | With values 0 before and 1 after first cohabitation experience.

* Health | Fixed | Measured at the time of the survey in three categories: Good, Regular, Bad.

Other relevant covariates were tested for inclusion finding no significant effects:

* Nationality: European vs. Other.

* Values: Conservative, Center, Liberal. Built from a question regarding the need to give priority to men when jobs are scarce and another on the place of paid and unpaid work for women's realization.

* Religiosity: High, Medium, Low.

* Cohort: Born 1958-1972, 1973-1983.

And a third group of variables were also tested and although they might have shown significant effects, were ultimately excluded from the model given timing issues and/or their strong correlation with age:

* Type of current job: Public vs. Private.

* Type of current job: Temporary vs. Stable.

* Type of current job: Full Time vs. Part-time.

* Activity: Employed, Unemployed, At home, Inactive, Other.

* Total household income (per capita).

In the next section to observe we compare trajectories from three different cohorts in order to observe the evolution over time of employment instability: those that entered the labor market between 1942 and 1956 (born 1926-40). Those that entered in 1962 to 1976 (born 1946-60) and 1980 to 1994 (born 1964-68). Later we focus on the younger cohort to analyze the effects of this increased instability on the timing of first births.

# 5 Results

## 5.1 Evolution over time of education-employment trajectories

Figures 2 and 3 show the labor market trajectories of men and women in the first cohort (labor market entry 1942-1956). At each time, from age 16 to age 60, the graph shows the proportion of individuals in each state. As expected the *inactive* state gets a large proportion of women's trajectories while it is marginal in the case of men. What was less expected is the large amount of *self-employment* among men and the high proportion of *help at home* at the beginning of trajectories. Another interesting element to notice is the clear delimitation of the *military service* period, which indicates a high degree of accuracy in the data.

Figure 2: Education-Employment trajectories Men 1942-1956 (born 1926-40) | France

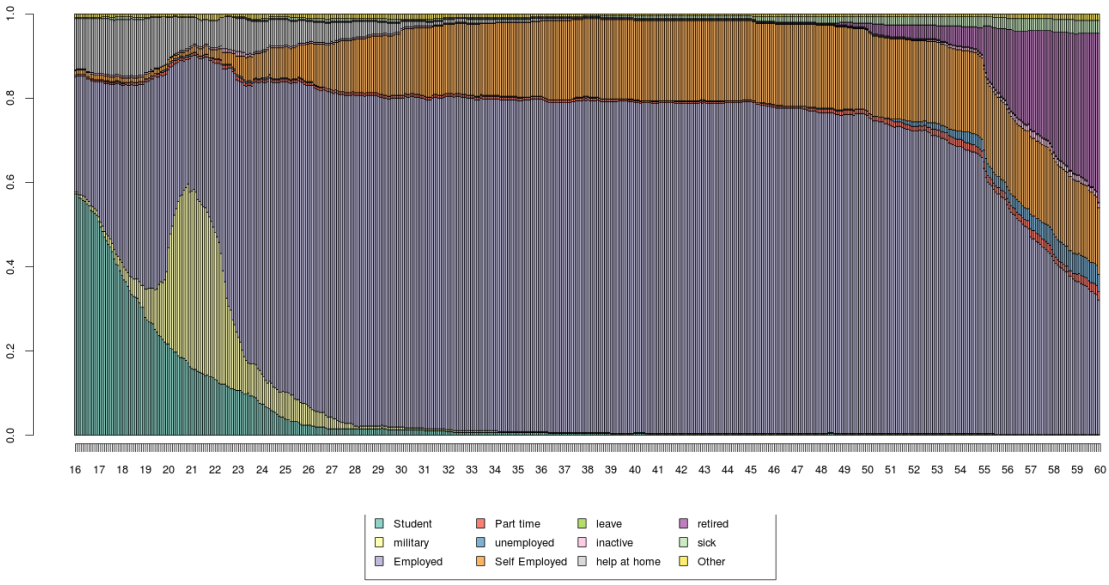
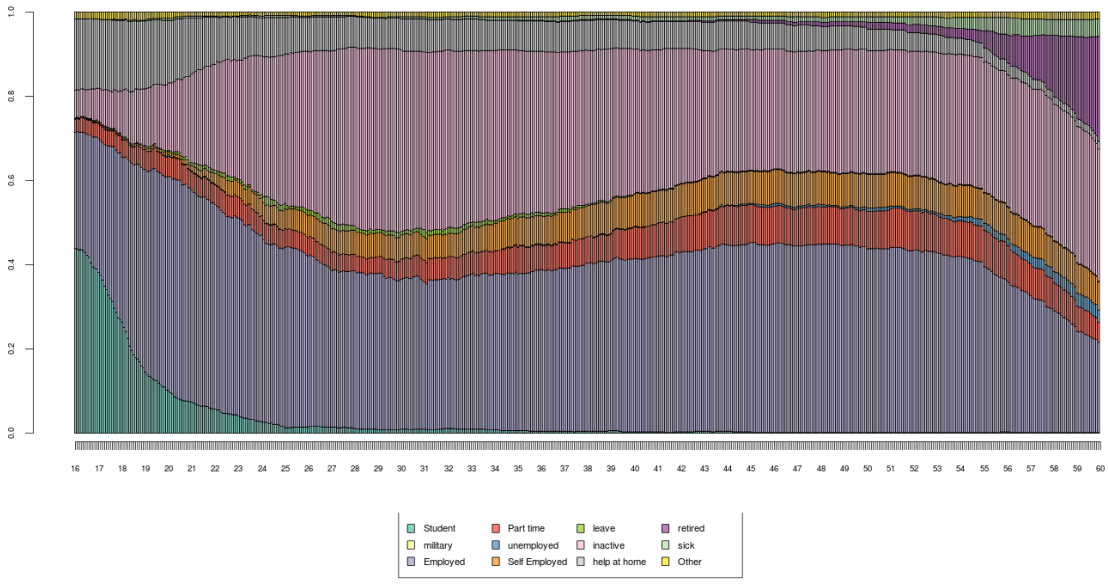



Figure 3: Education-Employment trajectories Women 1942-1956 (born 1926-40) | France




What stands out immediately for the second cohort is the high degree of stability of men's trajectories. States other than *employed* or *self-employed* are very infrequent. At the same time we see a convergence of women's trajectories towards men's trajectories, although they still present a higher proportion of *part-time employment* and *inactivity*.

Figure 4: Education-Employment trajectories Men 1962-1976 (born 1946-60) | France

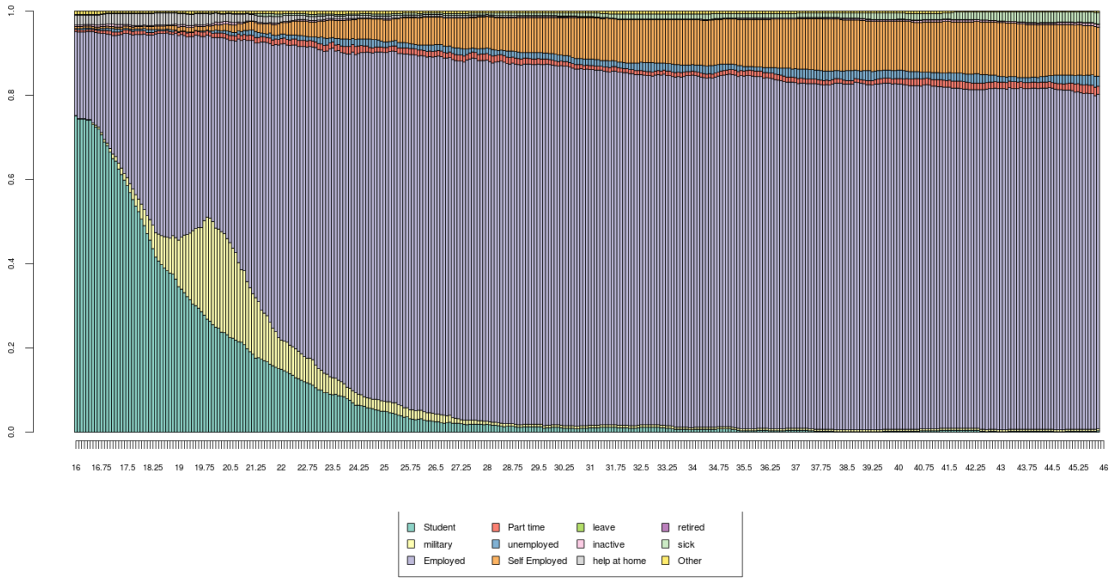
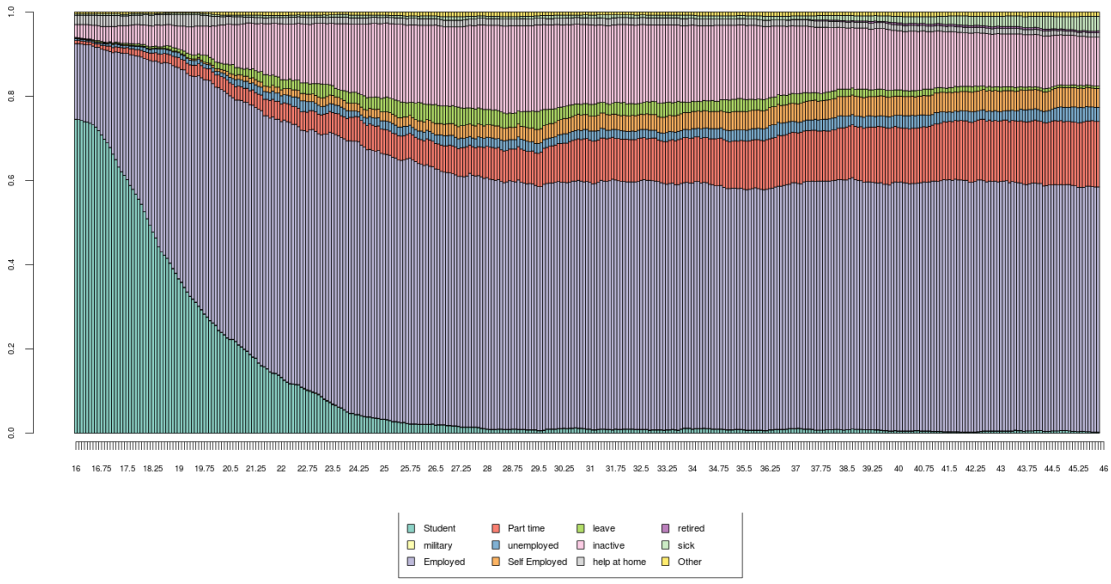



Figure 5: Education-Employment trajectories Women 1962-1976 (born 1946-60) | France




The most recent cohort shows exactly what was predicted: *unemployment* and *part-time employment* proportions increase for both men and women, generating more instability when we consider individual trajectories. This confirms our hypothesis H1: Turbulence of education-employment trajectories has increased over time. Younger cohorts experience more instability in the labor market. A conclusion that can be also obtained by inspecting the distribution of turbulence by cohort (omitted).

Figure 6: Education-Employment trajectories Men 1980-1994 (born 1964-68) | France

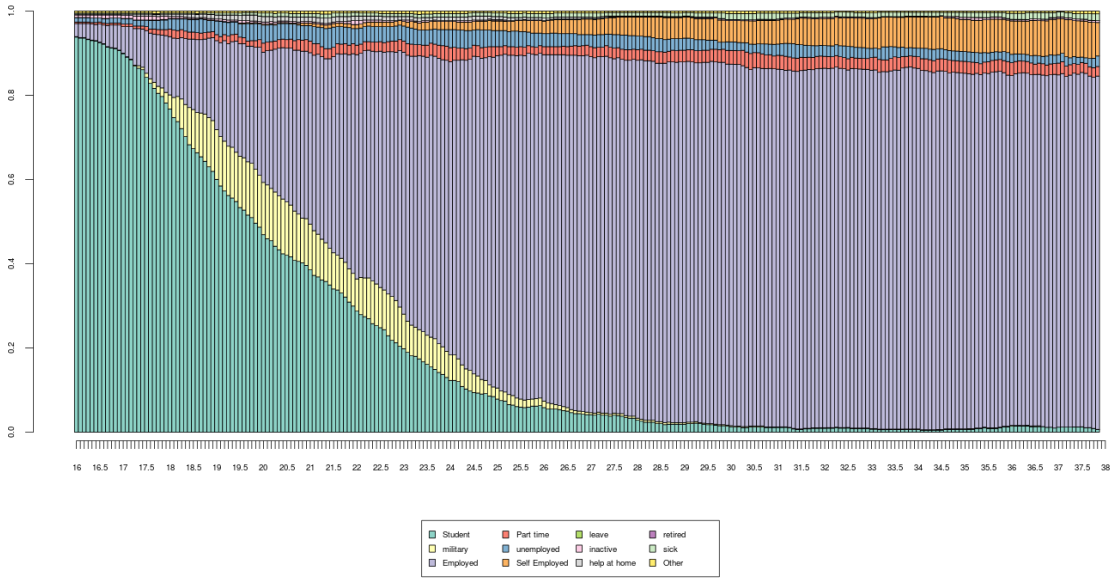
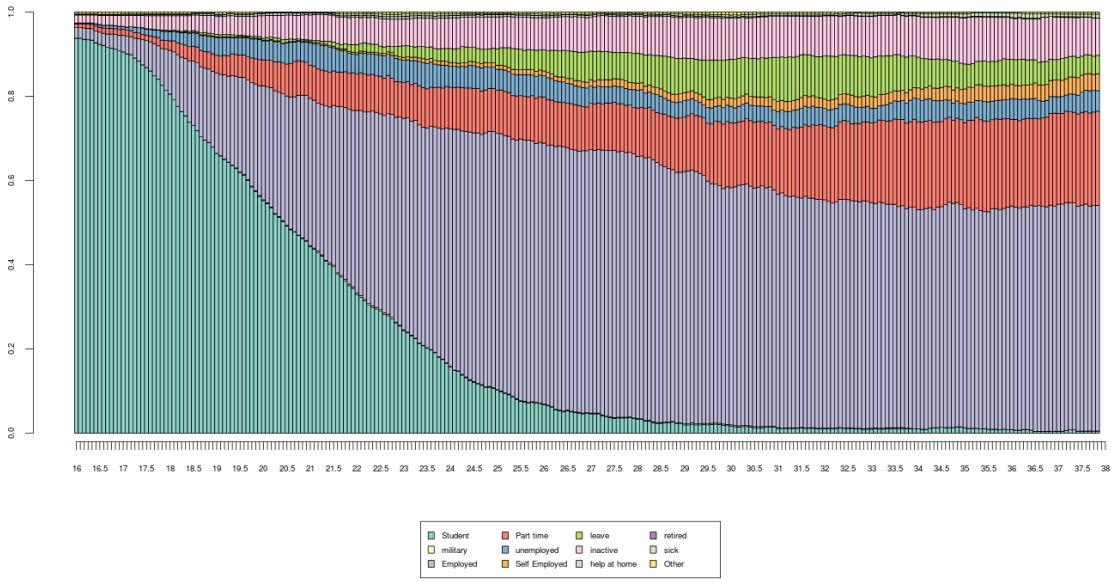



Figure 7: Education-Employment trajectories Women 1980-1994 (born 1964-68) | France

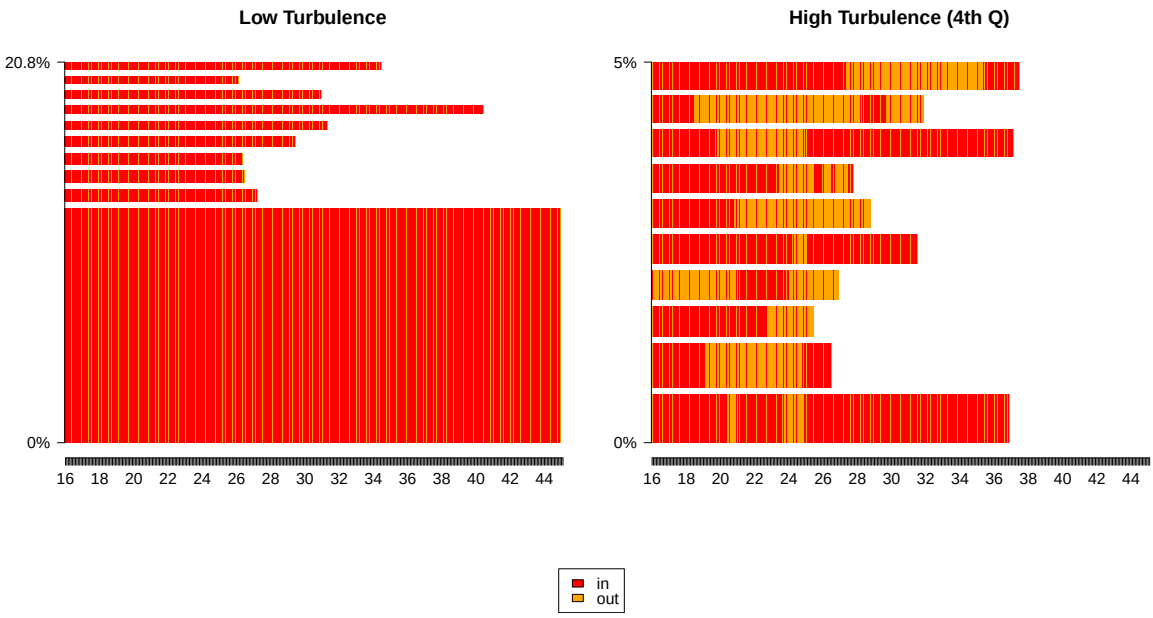



## 5.2 An Inspection of Highly Turbulent Sequences

Figure 8 shows the 10 most representative sequences of two groups in our sample. The left side corresponds to the group with low turbulence sequences, defined as the first three quartiles of the distribution. The right side corresponds to the high turbulence group and includes the last quartile. The sequences in the latter are characterized by multiple transitions in and out of the *stable*. The *out* periods represent spells of

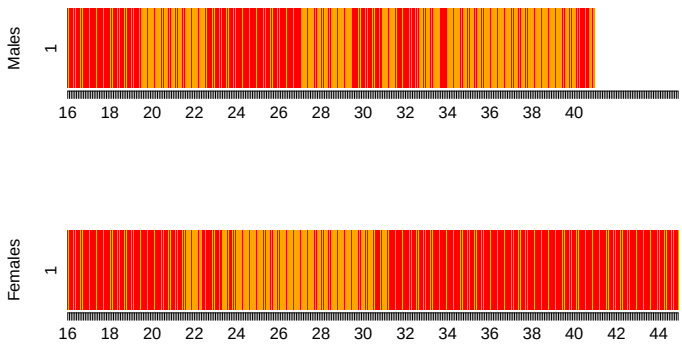
*unemployment* or *part-time employment*. The most representative sequence (lower) in this group has two unemployment/part-time spells, a shorter one around age 21 and a longer one around 24.

Figure 8: 10 Most Representative Sequences of the Groups With Low (1st to 3rd quartiles) and High (4th quartile) Turbulence.




The ten most representative sequences in the low turbulence group have no transitions and no difference other than their length. Together they represent almost 21% of the distribution of sequences in the group. In the case of the high turbulence group these ten sequences only represent 5% of the trajectories in the group. Is worth noting that the sequences in this group are most likely the least turbulent since they match other cases in the group (the higher the turbulence the less probable to find identical sequences).

Figure 9: Most Turbulent Sequences for Males and Females




In figure 9 we present the most turbulent sequences for men and women. They have 6 and 4 unemployment/part time spells respectively. In the second case the spells are concentrated between age 22 and 32 and in the first the spells are more spread throughout the sequence.

## 5.3 Effects of Employment Instability on the Timing of First Births

As mentioned before, to evaluate the effect of instability of employment trajectories on fertility timing we computed the cumulative turbulence at each age since age 17 to age 45. This variable was later included in a Cox Proportional Hazards model with two other control variables, Education and the Timing of the First Union. Two models were fitted, one for males, one for females, defined as follows:

$$h^m(t,x) = h_0(t)^m * exp(x\beta_{turb} + x\beta_{funion} + x\beta_{edu}) \tag{1}$$

$$h^f(t,x) = h_0(t)^f * exp(x\beta_{turb} + x\beta_{funion} + x\beta_{edu}) \tag{2}$$

The results of these two models are shown in Table 4. In the case of men the results for the effect of turbulence are in line with our hypothesis H2: having *high* turbulence reduces the hazard of having a first child by 15%. In the case of women the effects are also negative but not significant. Having experienced cohabitation significantly

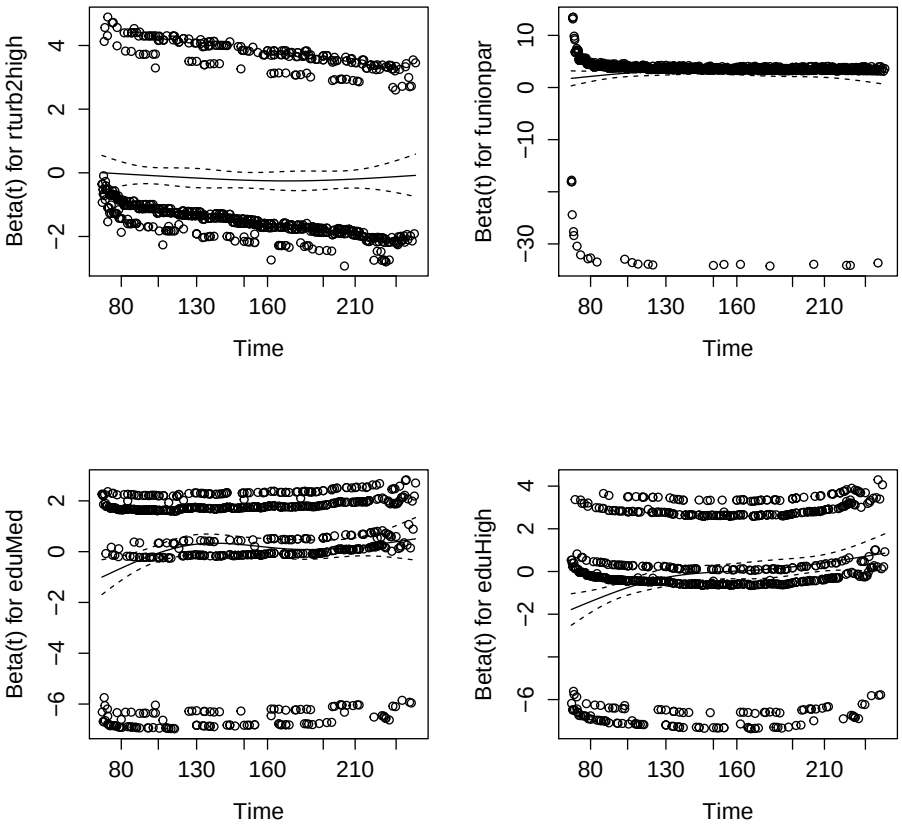
increases the hazard of a first birth as was also expected. But the model still needs to be tested in its main assumption: the proportionality of these effects over the hazard. To this end we present plots of scaled Schoenfeld Residuals against time, Figures 10 and 11.

Table 4: Cox Proportional Hazards Model | Age 25 to 50. Turbulence Prior to First Child

| | Males | Females |
|---|---|---|
| Low Turbulence *(ref)* | | |
| High Turbulence | $-0.16$ (0.08)$^{*}$ | $-0.05$ (0.07) |
| First Union - No *(ref)* | | |
| First Union - Yes | 2.83 (0.21)$^{***}$ | 2.40 (0.15)$^{***}$ |
| Low Education *(ref)* | | |
| Med Education | 0.06 (0.10) | $-0.27$ (0.08)$^{***}$ |
| High Education | $-0.23$ (0.11)$^{*}$ | $-0.64$ (0.08)$^{***}$ |
| Num. events | 834 | 1233 |
| Num. obs. | 18412 | 21437 |
| Missings | 0 | 0 |

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$

Figure 10: Scaled Schoenfeld Residuals Against Time. Fit Males




The plots of Schonfeld residuals against time show deviations of the proportionality assumption for both education coefficients (the smoothed line shows a trend over time) for both males and females. In the latter case the effect of turbulence seems also to depart from an horizontal line, showing a declining trend over time. To better understand the trends in the different categories of education we plot Kaplan-Meier estimators (observed survival curves) for the three groups in Figure 12

Figure 11: Scaled Schoenfeld Residuals Against Time. Females

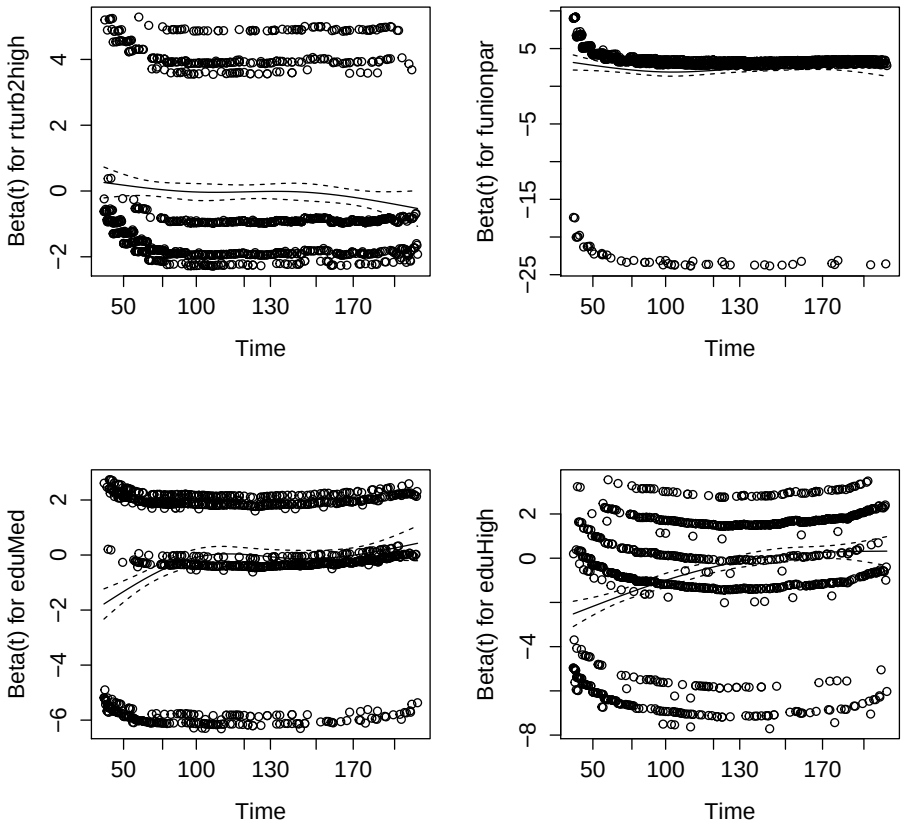
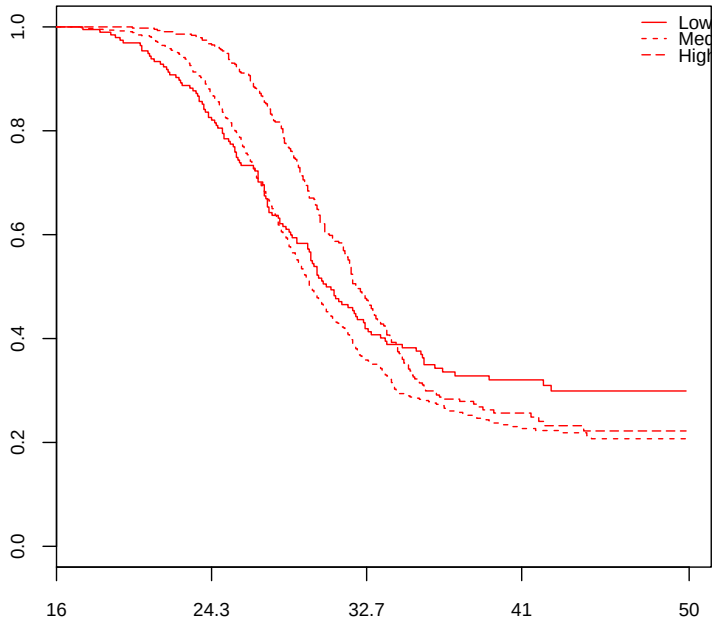


Figure 12: Observed Survival Curves | Education, Males




It is clear that the effects of education on survival are clearly non-proportional. Those with high education have significantly lower hazards at the beginning of the duration but they quickly catch up, reaching the levels of those with low education around age 35. This could be dealt with by interacting the effect of those with high education with time before and after age 35. This strategy, however, does not solve the other non-proportionalities observed between the other categories. Therefore, considering that we are not interested in the effect of education per se, we decided to stratify the model over education categories, allowing for three different baseline hazards. Therefore, the new specifications are:

$$h^m(t,x) = h_{0_{edu}}(t)^m * exp(x\beta_{turb} + x\beta_{funion}) \tag{3}$$

$$h^f(t,x) = h_{0_{edu}}(t)^f * exp(x\beta_{turb} + x\beta_{funion}) \tag{4}$$

Table 5 contains the results of the new models. The effects of Turbulence maintain their direction and significance levels. The hazard for those with high turbulence is 16% and 5% lower, males and females respectively. We proceed to further explore the effects of turbulence by comparing observed and fitted survival curves.

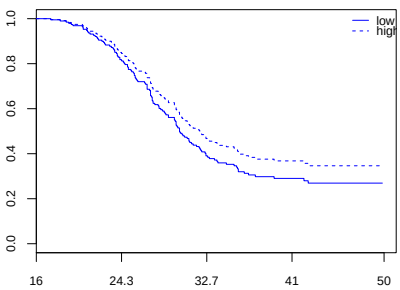
Table 5: Extended Cox Model Estimates | Age 25 - 50. Turbulence Prior to First Child

| | Males | Females |
|---|---|---|
| Low Turbulence *(ref)* | | |
| High Turbulence | $-0.17$ $(-16\%)^{*}$ | $-0.06$ $(-6\%)$ |
| | | |
| First Union - No *(ref)* | | |
| First Union - Yes | 2.77 $(+16)^{***}$ | 2.28 $(+10)^{***}$ |
| Num. events | 834 | 1233 |
| Num. obs. | 18412 | 21437 |
| Missings | 0 | 0 |

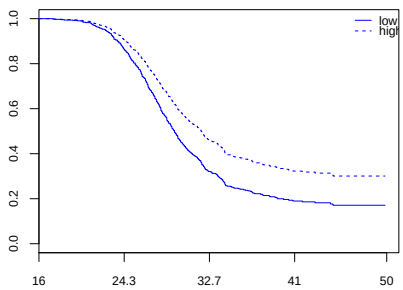
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$

Figure 13 shows fitted survival curves by turbulence and education level. The effects of instability is more noticeable among those located at the center of the education distribution.

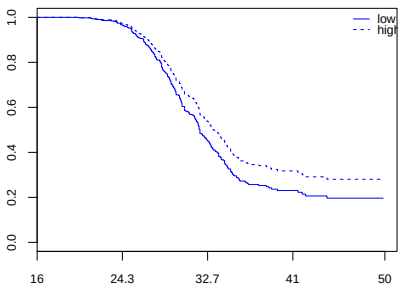
Figure 13: Fitted Survival Cohorts, Turbulence on First Child by Education |Males




(a) Low Education




(b) Medium Education

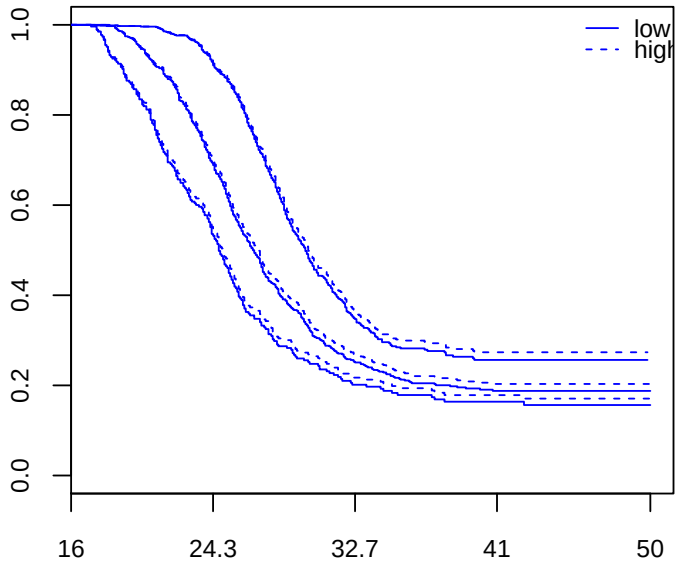



(c) High Education

Figure 14 shows the fit of the model for women. In this case the three education levels are depicted in the same graph. Although the direction is the same as in the case of

males: those with higher turbulence have lower risks of having children at each age, the gaps are significantly smaller and the effects not significant.

Figure 14: KM, First Child, by Turbulence and Education |Females




# 6 Discussion

In the context of a remarkable shift in the longstanding negative correlation between economic prosperity and fertility levels, our study was set to analyze the effects of employment instability and the timing of fertility in France. The two main questions hypotheses we posed were confirmed by our results.

First, we showed how the unemployment and part-time job episodes in individuals' biographies have increased over time, resulting in more complex and unstable trajectories. These result we obtained for men and women and we interpret them, at least partially, as the result of the process of flexibilization of the French labor market, a process observed in most European countries in the last decades.

Our second objective was to assess the effects of this increased instability on the timing of first births. Here we found clear effects for men, as expected, and less clear effects for women. At the price of losing some comparability, the representation of the

employment instability process in the case of women might need a different definition than the one proposed here. Regardless and in addition, we believe that modeling improvements that could not be performed here could also lead to more robust and statistically significant results.

Beyond our substantive considerations, one of our primary goal was to develop an innovative and robust measure of employment instability over the life course, taking advantage of the potentialities of sequence analysis. The proposed measure has the advantage of incorporating the information contained in the entire education-employment trajectory of individuals, if at the price of a less clear cut interpretation than more frequently used indicators.

Although the measure can be improved in many different ways, some of which we have mentioned here, we hope the reader is now convinced that the use of turbulence in labor market trajectories can provide a good measure of employment instability and a robust predictor of fertility outcomes.

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