Women's Noncognitive Skills and Transition to Employment after Childbirth

Eva M. Berger*

April 2010

Preliminary version

Abstract

The aim of this paper is to investigate the role of noncognitive traits for the duration of women's career breaks after first childbirth. It thus links the existing literature on the determinants of mothers' return to employment with the very recent literature on the economic role of noncognitive skills. Using data from the German Socio-Economic Panel Study (SOEP) and referring to the concepts of Locus of Control and the Big Five personality traits, a discrete semi-parametric survival model is estimated incorporating a discrete mixture distribution to summarize unobserved individual heterogeneity. The estimation results confirm predictions according to which women with a highly external Locus of Control return to employment later than women with a more internal Locus of Control. Within the Big Five personality traits, the dimension Agreeableness is further found to be associated with a late transition to employment.

Keywords: Noncognitive skills, personality, maternal employment, female labor supply, survival analysis

JEL-codes: J22, J24

*German Institute for Economic Research (DIW Berlin) and Freie Universität Berlin. Office address: DIW Berlin, Mohrenstraße 58, 10117 Berlin, Germany. Phone: +49-30-89789 228. Fax: +49-30-89789 109. E-mail: eberger@diw.de.

1 Introduction

There is a large literature on the determinants of mothers' transition to employment after childbearing. The duration of non-participation after childbearing matters because long periods of non-employment cause a loss in human capital and future wages. The devaluation of human capital is especially relevant for highly educated workers among whom a large and increasing proportion are women. In the light of the demographic change, the labor force of mothers plays an increasingly important role for the economy, in which more and more industries faces problems in covering their need of skilled work force. The existing literature in the field of mothers return to employment after childbearing mainly focuses on the question of how institutional factors, such as parental leave schemes or tax regimes, affect the duration of child-related career breaks. Related studies are Burgess, Gregg, Propper, and Washbrook (2008), Gutierrez-Domenech (2005), and Ondrich, Spiess, Yang, and Wagner (2003), who also provide recent reviews of this literature. While it was concluded that policy measures can have a measurable impact on mothers' labor supply decisions, it emerges that individual characteristics such as educational attainment are also highly important determinants and that a substantial part of the variation between women has still remained unexplained. The aim of this paper is to contribute to this literature by more deeply investigating the role of individual characteristics, namely mothers' noncognitive traits or personality traits. As to my knowledge, there is no previous study that empirically investigates the impact of noncognitive traits on women's return to employment after childbirth. However, understanding the mechanisms of individual factors is important when designing policy measures.

Recent economic studies found that noncognitive skills play an important role in economic and social success such as educational attainment (Blomeyer, Laucht, Coneus, and Pfeiffer 2009, Coleman and DeLeire 2003, Coneus, Gernandt, and Saam 2009, Heckman, Stixrud, and Urzua 2006), employment and unemployment probabilities (Heckman, Stixrud, and Urzua 2006, Uhlendorff 2004, Wichert and Pohlmeier 2010), and earnings (Andrisani 1977, 1981, Cebi 2007, Heckman and Rubinstein 2001, Heckman, Stixrud, and Urzua 2006, Heineck and Anger 2010, Osborne Groves 2005). The term noncognitive skills refers to traits other than cognitive ability that describe individual differences that are related to a number of outcomes.[1] Heckman, Stixrud, and Urzua (2006) found that the impact of noncognitive traits on the employment probability is even larger than that of cognitive skills and that this pattern is more pronounced for women than for men.[2] This

[1] For a further discussion of the term noncognitive skills, see Borghans, Duckworth, Heckman, and ter Weel (2008).

[2] More concretely, the authors look at a single noncognitive factor constructed using the Rotter Locus of Control Scale and the Rosenberg Self-Esteem Scale. They find that a change of the non-cognitive measure by one standard deviation has a larger effect on employment probabilities than a one-standard deviation change of cognitive skills.

is likely to be related to the fact that women face more frequently the trade-off between family and career, and the behavior toward this trade-off is to a larger extent influenced by noncognitive traits. To examine this issue in more detail, it appears useful to examine women with young children because these women face the family-career trade-off to a particularly high extent. This is what is done in the present paper, bringing together the two strands of literature, i.e., that of women's return to employment after childbearing and that of the economic role of noncognitive skills.

The noncognitive traits focused on in this paper are Locus of Control and the Big Five personality traits. Using data from the German Socio-Economic Panel Study (SOEP), I estimate a discrete semi-parametric survival model incorporating a discrete mixture distribution to summarize unobserved individual heterogeneity, as proposed by Heckman and Singer (1984). The results indicate that women with a highly external LOC and women with a high score on Agreeableness return to employment later. These effects are especially pronounced for the more homogeneous group of women who were employed prior to childbirth.

The paper is organized as follows: Section 2 specifies the concept of noncognitive skill measures used in this analysis. Section 3 describes the data base and variables used. Section 4 exposes the estimation method. The results are reported and discussed in Section 5. Section 6 presents several robustness checks. Section 7 concludes.

2 The concept of noncognitive traits and the role in maternal employment decisions

The analysis in this paper refers to two concepts of noncognitive skill measures, namely Locus of Control (LOC) and the Big Five personality traits. In the following two subsections, the two concepts are presented and the expected effects on a woman's decision to return to employment after childbirth are discussed.

2.1 Locus of Control

The concept of LOC is a measure of the "individual differences in a generalized belief for internal versus external control of reinforcement" (Rotter 1966, p. 1). It is a measure of the degree to which an individual perceives that success or failure follows from his own behavior or attributes versus the degree to which he feels that it is controlled by forces outside of himself and may occur independently of his own actions. If a reinforcement is perceived by the subject as being contingent upon his own behavior or his own relatively permanent characteristics, this is labeled an *internal* LOC. If, on the other hand, a reinforcement is perceived by the subject as the result of luck, chance, fate, as under

the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him, this is labeled an *external* LOC.

Coleman and DeLeire (2003) argue that LOC affects the decision to invest in human capital through its impact on expected earnings. The authors develop a model of schooling decisions as a function of expected future earnings. They incorporate individual LOC in the model arguing that the expected increase in future earnings induced by an extra year of schooling will be higher for individuals with a more internal LOC than for individuals with a more external LOC. In this paper, a similar argumentation is adopted for the investment in work experience, which, besides schooling, influences future earnings — according to the Mincer model of earnings (see Mincer 1958, 1974). The earlier a woman returns to employment after childbearing the more work experience she will gain. Therefore, returning to employment shortly after childbirth can be interpreted as an investment in human capital. This interpretation is especially relevant as child-related career breaks usually occur at an early stage of a woman's career when each year of work experience is still relatively highly rewarded on the labor market. Hence, one would expect LOC to affect the return decision of a woman after childbirth as follows: Individuals with a more internal LOC should return earlier than persons with a more external LOC. If a woman believes that her future career depends to a large extent on luck or powerful others rather than on her work experience, she might return later than persons who are convinced that their future career chances highly depend on their previous engagement.

Second, one might expect that women with a more internal LOC are be more resolute in trying to find a solution to reconcile work and family life as soon as they wish to return to employment. Women with a more external LOC are more likely to accept a situation where they are not able to combine paid work and family because they feel unable to change the situation.

A third argument would be that LOC affects the job search intensity. Caliendo, Cobb-Clark, and Uhlendorff (2009) found that external LOC is associated with a lower job search intensity of unemployed persons. A woman who decided to (re-)enter employment after childbearing might take some time until she finds a new job. One might expect mothers with a highly external LOC to search less intensively and thus to find later a job and thus to return later to employment after childbirth. However, this argument is only relevant for women who cannot return to their previous position, for example, because their temporary contract expired in the meantime or because they were not employed prior to childbirth. Usually, women have the right to return to their previous position within three years after childbirth. Thus these women do not have to search for a new job when they want to return to employment. I will come back to this argument further below in this paper.

An argument to expect an opposite effect would be that women with a more internal

LOC are more considerate with their children. They might believe to a higher degree that their behavior and the caring conditions strongly influence the development of a child. This might lead them to prefer to care for their children themselves rather than placing the responsibility to someone else and giving the child in some external care. If this is true and the effect is dominant, women with internal LOC would tend to return to employment later. However, one might also expect that these women place their children in thoroughly selected high quality care to stimulate the development of their children rather than only allowing for parental care. Finally, there would be no reason left for them to return to employment later.

2.2 The Big Five personality traits

The Big Five personality traits refer to a concept in personality psychology according to which a personality can be described by the five dimensions *Neuroticism* (emotional instability), *Openness to Experience*, *Conscientiousness*, *Extraversion*, and *Agreeableness* (John and Srivastava 1999, McCrae and Costa Jr 1996, 1999). The Big Five concept is among the best-established models in personality psychology and widely used in empirical research(Caspi, Roberts, and Shiner 2005).

The trait *Neuroticism* characterizes how individuals experience strong positive and negative emotions, i.e., their emotional stability. Individuals with a high score on Neuroticism cannot cope with stress, they worry a lot and get frustrated and nervous easily. Neurotic mothers might be less prepared to cope with the family-work conflict. Also, neurotic persons might cope less well with occupational stress in general. Wichert and Pohlmeier (2010) find that women with a higher Neuroticism score are less likely to participate in the labor force. Accordingly, for mothers after childbirth one would expect that Neuroticism is associated with a later return to employment. Also, neurotic women might worry a lot about their child's behavior and development and therefore they might decide to be with the child as long as possible and not to return to employment too early. On the other hand, one could think that neurotic individuals worry more about their future job chances and are more afraid that a long period of non-participation increases future unemployment risk. This might then lead them to return early in order to minimize future problems. Vearing and Mak (2007) find that a high score of Neuroticism leads to a high work commitment (even an over-commitment), which supports the hypothesis of an early return to employment. Which of the two opposite effects finally dominates will be an empirical issue.

The personality trait *Openness to Experience* describes how needy an individual is for changes and novelty and whether she has an active imagination and frequently comes up with new ideas. One could expect that an open woman appreciates the new life style

when having her first child and enjoys becoming acquainted with new aspects of life. In general, open individuals might appreciate activities other than employment because this might imply a high variety in experiences. In line with this argument, Wichert and Pohlmeier (2010) find that open women are less likely to participate in the labor force. On the other hand, one could think of open individuals being bored by a life staying at home and exclusively caring for their child. They might appreciate employment because it brings a certain amount of diversity in their lives. If this is true, mothers with a high score on this personality trait might return earlier. Again, it will be an empirical issue to find out which of the opposite effects dominates.

Conscientiousness describes the way how people deal with problems. Conscientious people do things thoroughly, are organized, hard working, and ambitious. On the one hand, conscientious women feel responsible of their job tasks and therefore might return to employment relatively shortly after childbirth. Wichert and Pohlmeier (2010) find that conscientious women are more likely to participate in the labor force in general. On the other hand, if Conscientiousness also implies that a woman feels particularly responsible for the development of her child, she might want to care for her child herself rather than placing the responsibility to someone else during employment hours. Again, it is unclear which one will be the dominant effect.

The trait *Extraversion* captures how an individual behaves among others. A person with a high level of Extraversion is outgoing, talkative, and sociable. One would expect extraverted women to enjoy the social contact brought by employment, that is, enjoy being with colleagues and business clients rather than staying at home. Wichert and Pohlmeier (2010) find that extraverted women are in general more likely to participate in the labor force. This leads us to expect extraverted mothers to return to employment relatively shortly after childbirth.

A person with a high score on the trait *Agreeableness* is altruistic, has a forgiving nature, and is considerate and kind to others. Agreeable women tend to be altruistic towards their spouse and therefore might be more likely to resign from their own career ambitions. Also, agreeable women might avoid the work-family conflict, which is likely to arise for employed women with young children. Also, agreeable women might be more likely to adopt to traditional (western German) social norms in that a mother with a young child should stay at home. Wichert and Pohlmeier (2010) do not find a significant relationship between the trait Agreeableness and the probability to participate in the labor force. The pattern could be different, however, when focusing on women with young children.

3 Data

The empirical analyses in this paper are based on data from the German Socio-Economic Panel Study (SOEP), an annual household panel study, which is representative of the population in Germany (Wagner, Frick, and Schupp 2007). In the sample used for the present analysis, I include women who had their first child between 1992 and 2007 and who do not enter unemployment[3] or education subsequently. A mother's employment status is observed on a monthly basis from the fourth month after childbirth until she returns to employment or the observation period is censored. The first three months after childbirth are left out because a mother is in maternity protection leave (*"Mutterschutz"*) in the first eight weeks after a regular birth and in the first twelve weeks after a multiple birth or a preterm birth. During this period some women are still observed as employed though being in leave. Censoring occurs when the current end of the survey (end of year 2007) is reached before a transition into employment is observed. Censoring also occurs when a respondent leaves the survey or does not respond in one year following the birth and before a transition to employment is observed. Individuals for whom a transition into unemployment or education is observed (before a transition into employment is observed) are discarded from the sample. In total, the sample contains 23,736 person-month observations from 906 individuals observed between a minimum of one and a maximum of 182 time spells (months). For 680 individuals (75%) a transition into employment is observed, the mean number of spells for them is 21 (std. dev. 24.13). The remaining 226 individuals (25%) are censored, the mean number of spells for them is 42 (std. dev. 44.62). When the sample is reduced to include only women who were employed prior to childbirth (that is, those who are employed at the time of at least one interview within the last four yearly interviews prior to childbirth) and labor earnings are also observed, the sample size reduces to 666 individuals.

3.1 Measures of noncognitive traits

As exposed above, this study uses two types of noncognitive skill measures, Locus of Control and the Big Five personality traits. The Locus of Control measure used in this analysis is based on five items surveyed by the 2005-wave of the SOEP.[4] The items were to be answered on 7-point Likert type scales (1 "disagree completely" to 7 "agree completely"). A list of the items (English translation) and the means and standard deviations of the non-standardized scores are reported in Table 1. The Locus of Control measure used in the estimation models below is the average of the standardized (to mean

[3] A person is defined unemployed if she has been registered as unemployed at the Employment Office.

[4] Another five items that have been surveyed in the same block of the 2005 SOEP questionnaire are not incorporated in the measure because the items refer to concepts different than the Locus of Control.

zero and standard deviation one) scores of the five items.[5] The variable is to be interpreted in the way that the higher the score, the more external the LOC.

For the Big Five personality traits, the 2005-wave of the SOEP survey provides a set of fifteen items — three for each of the five dimensions. They were, like the Locus of Control items, to be answered on a 7-point Likert type scale (1 "does not apply to me at all" to 7 "applies to me perfectly"). A list of the items (English translation) as well as the means and standard deviations of the (non-standardized) scores are given in Table 1.[6] The variables for the five dimensions used in the estimation models below are the average of the standardized answer scores.

Since the non-cognitive traits have been surveyed only once in the SOEP, namely in the 2005-wave, I have to assume that the traits are stable over time for each individual. This is plausible since psychologists found that personality traits are largely consistent across time and age (Fraley and Roberts 2005, Roberts and DelVecchio 2000). In the studies of Heckman, Stixrud, and Urzua (2006) and Coleman and DeLeire (2003) a similar assumption is made as their measure of noncognitive traits is also available only in one wave of the data set. Nevertheless, a robustness test will show below that the results are not substantially changed by this assumption.

3.2 Further covariates

Apart from the above given noncognitive measures, a number of socio-economic and demographic characteristics are controlled for in the estimations. These are age at first birth, age squared, education, labor market experience (in years), log of the net inflation-adjusted other household income (in euros), partner status, whether other adults are living in the household, whether the person lives in eastern Germany, migration background, health, whether the women has a second child within four years after the first birth, whether the women has a third child within six years after first birth, and birth cohort dummies for the year of the first birth. When reducing the sample to only those women who were employed prior to childbirth, log of hourly wage is included as an additional covariate in the model.[7]

Since all these covariates have not been surveyed every month but only on a yearly basis, they are taken from the latest interview year (i.e., when the transition into employ-

[5] A similar measure has been used by Coleman and DeLeire (2003) with the LOC-items from the National Educational Longitudinal Study (NELS) and by Cebi (2007) with the LOC-items from the National Longitudinal Survey of Youth (NLSY).

[6] For more information on the implementation of the Big Five traits in the SOEP survey as well as on the reliability and validity, see Dehne and Schupp (2007).

[7] For the calculation of hourly wages, the inflation-adjusted gross labor income (in euros) is divided by the number of actual weekly working hours times 52/12. The actual working hours are used instead of the number of hours stipulated in the contract because for self-employed the latter does not exist and for some other cases there are also missing values in the variable.

Table 1: Summary statistics of the items of the Big Five personality traits and of Locus of Control

Item	Mean[a]	Std. dev.
Locus of control (LOC)		
How my life goes depends on me (reversed)	2.47	1.23
What a person achieves in life is above all a question of fate or luck	3.59	1.63
I frequently have the experience that other people have a controlling influence over my life	2.96	1.59
The opportunities that I have in life are determined by the social conditions	4.57	1.42
I have little control over the things that happen in my life	2.53	1.43
Big Five personality traits: *I see myself as someone who...*		
Neuroticism:		
worries a lot	4.93	1.59
gets nervous easily	3.87	1.63
is relaxed, handles stress well (reversed)	3.69	1.48
Openness:		
is original, comes up with new ideas	4.63	1.39
values artistic experiences	4.19	1.80
has an active imagination	4.90	1.53
Conscientiousness:		
does a thorough job	6.24	0.91
tends to be lazy (reversed)	5.83	1.44
does things effectively and efficiently	5.86	0.99
Extraversion:		
is communicative, talkative	5.73	1.18
is outgoing, sociable	5.28	1.41
is reserved (reversed)	4.10	1.71
Agreeableness:		
is sometimes somewhat rude to others (reversed)	5.20	1.61
has a forgiving nature	5.49	1.29
is considerate and kind to others	5.93	1.01

Note: author's calculations with data from the SOEP, 2005, sample described in the text, N = 907 individuals. The numbers refer to non-standardized answer scores ranging from one to seven (7-point Likert scale).

ment or censoring is observed) and are included in the survival model as time-constant covariates. Exact definitions of the covariates are given in Table 2. Summary statistics for the covariates are reported in Table 3.

4 Method

I estimate a Prentice and Gloeckler (1978) model incorporating a discrete mixture distribution to summarize unobserved individual heterogeneity, as proposed by Heckman and Singer (1984). This discrete survival model appears to be appropriate for the analysis of the interval-censored (monthly) time spells. The non-parametric modeling of the baseline hazard and the non-parametric approach of characterizing the unobserved heterogeneity allows a high degree of flexibility in the model. The proportional hazard property of the model implies that absolute differences in the covariates imply proportionate differences in the hazard at each spell (month). The hazard model can be formulated in a complementary log-log form as

$$h(j, X) = 1 - \exp[-\exp(\gamma_k D_k + \beta' X)],$$

where $h(j, X)$ is the hazard rate, which is a function of the spell length j (that is, the month after childbirth minus three) and the vector of covariates X. The vectors β and γ contain the related parameters that are to be estimated by the model. The baseline hazard is not specified parametrically, that is, I estimate a semi-parametrically specified hazard model. The duration dependency of the hazard rate is contained in $\gamma_k D_k$, where D_k is an indicator equal to one if month j lies within the k^{th} group of months and zero otherwise. That is, the model contains one dummy variable for each group of months but not for each single month because this would overload the model and could not be estimated with the available data. The groups of months are defined as follows: The first group includes months four to 6 (the first three months are left out because return is only considered from the fourth month on as explained above), the second group months seven to nine, the third group months ten to twelve. From the second to the fourth year always six months are included in one group, from the fifth to the seventh year twelve months per group, from the eighth to the ninth year 24 months per year, and the last group encompasses all remaining months.

To allow for unobserved heterogeneity without assuming a specific distribution for the random effect, it is assumed that there are two types of individual in the population. This idea is incorporated by allowing the intercept β_0 to vary between the two classes, i.e.,

$$h_1(j, X) = 1 - \exp\left[-\exp(\gamma_k D_k + \beta_{01} + \beta' X)\right]$$

Table 2: Variable definitions

Variable	Definition
LOC	*Locus of Control*: Average of the standardized answer scores of the five related items given in Table 1; a high value reflects strong belief in external control of reinforcement
Neuroticism	Big Five personality trait *Neuroticism*: Average of the standardized answer scores of the three related items given in Table 1
Openness	Big Five personality trait *Openness*: Average of the standardized answer scores of the three related items given in Table 1
Conscientiousness	Big Five personality trait *Conscientiousness*: Average of the standardized answer scores of the three related items given in Table 1
Extraversion	Big Five personality trait *Extraversion*: Average of the standardized answer scores of the three related items given in Table 1
Agreeableness	Big Five personality trait *Agreeableness*: Average of the standardized answer scores of the three related items given in Table 1
Age first birth	Age at first childbirth
Educational degree:	
University	Indicator variable equal to one if the highest educational degree is a university degree (*Universität, Hochschule, Fachhochschule*)
Vocational	Indicator variable equal to one if the highest educational degree is a vocational degree (*Berufsausbildung, Lehre*)
No degree	Indicator variable equal to one if the person has no professional degree, i.e., neither a university degree nor a vocational degree
Experience	Number of years of labor market experience prior to childbirth
log(Other income)	Natural logarithm of the inflation-adjusted (to the base year 2001) net household income net of own labor earnings, in euros per month
Partner in HH	Indicator variable equal to one if the women is living with a partner in the same household
Other adults in HH	Indicator variable equal to one if one or more other adults (apart from a partner) are living in the same household
East Germany	Indicator variable equal to one if the woman lives in eastern Germany (former German Democratic Republic)
Migration background	Indicator variable equal to one if the women has a migration background
Health	Health status on a self-rated scale taking on values from 1 (bad) to 5 (very good)
2^{nd} child w/in 4 yrs	Indicator variable equal to one if the woman has a second child within four years after the first childbirth
3^{rd} child w/in 6 yrs	Indicator variable equal to one if the woman has a third child within six years after the first childbirth
log(Prior wage)	Natural logarithm of the inflation-adjusted (to the base year 2001) gross hourly wage before childbirth, in euros (only for women who were employed prior to childbirth)

Table 3: Summary statistics of covariates

	Mean	Std. dev.
LOC	-0.033	0.602
Neuroticism	0.008	0.741
Openness	-0.017	0.785
Conscientiousness	0.012	0.746
Extraversion	0.021	0.795
Agreeableness	-0.0002	0.709
Age first birth	28.15	4.659
$(\text{Age})^2/1000$	0.814	0.269
Educational degree		
University	0.178	0.382
Vocational	0.671	0.470
No degree	0.151	0.358
Experience	6.461	4.538
Other income	2,384	1,119
Partner in HH	0.933	0.251
Other adults in HH	0.033	0.179
East Germany	0.209	0.407
Migration background	0.140	0.347
Health	3.793	0.767
2^{nd} child w/in 4 years	0.417	0.493
3^{rd} child w/in 6 years	0.087	0.282
Prior wage[b]	11.85	5.886

Note: N = 906 individuals in the full sample. log(prior wage) refers to the reduced sample of women who have been employed prior to childbirth (N = 666). Author's calculations with data from the SOEP 1994-2007.

$$h_2(j, X) = 1 - \exp\left[-\exp(\gamma_k D_k + \beta_{02} + \beta' X)\right],$$

where $\beta' X$ does no longer contain an intercept. The likelihood contribution of a person with spell length j months is

$$L = \pi L_1 + (1 - \pi) L_2,$$

where

$$L_1 = \left(\frac{h_1(j, X)}{1 - h_1(j, X)}\right)^c \prod_{m=1}^{j} \left[1 - h_1(m, X)\right]$$

$$L_2 = \left(\frac{h_2(j, X)}{1 - h_2(j, X)}\right)^c \prod_{m=1}^{j} \left[1 - h_2(m, X)\right],$$

where π is the probability of belonging to type 1, and c is the censoring indicator. The parameters π, β_{01}, and β_{02} are estimated by the model together with β and γ.

5 Results

The estimation results of the above given model are reported in Table 4. Model 1 gives the results for the full sample, model 2 refers to the reduced sample, which includes only women who have been employed prior to their first childbirth. Model 3 also refers to the reduced sample and additionally controls for the wage earned prior to childbirth. The two main results of the estimations are that, firstly, individuals with a high belief in external control (high LOC-score) return to employment later than individuals with a more internal LOC. Secondly, women with a high degree of Agreeableness return to employment later than less agreeable women. For Locus of Control, the effect is only found for the reduced sample. It seems that for women who were not employed before having the first child, that is, women with a very low labor market attachment, LOC does not play a role for the decision whether and when to enter employment after childbirth. However, when focusing on the employed sample, LOC is highly predictive for the time to return to employment, even more predictive than the trait Agreeableness, which is significant in all three models. The effect of LOC stays significantly different from zero even when the hourly wage (in logs) is included in the set of covariates. Without including the wage, one could presume that the effect of LOC is solely due to the impact of LOC on wages. Also, one could think of LOC picking up the effect of cognitive rather than noncognitive skills if LOC is correlated with cognitive ability (the latter not being controlled for), which, in turn, is likely to affect wages. Since higher wages mean higher opportunity costs of staying outside the labor force, the estimated effect of LOC could be solely be the result of this mechanism. To see whether this is the case, (log of) prior wage is included

in the estimation model 3. As expected, the coefficient related to wage is positive and highly significant, which suggests that women with a higher wage prior to birth return to employment earlier. This is plausible since these women have higher opportunity costs of remaining non-employed. The LOC coefficient estimated by model 3 is similar to that in the model without wage and still highly significant. This suggests that there exists a direct effect of LOC on the decision to return to employment even when the opportunity cost is kept constant.

Table 4: Estimation of transition to employment by a discrete hazard model with a discrete mixture distribution to summarize unobserved heterogeneity

	(1)		(2)		(3)	
	coef	se	coef	se	coef	se
LOC	-0.084	(0.072)	-0.296**	(0.086)	-0.257**	(0.088)
Neuroticism	0.053	(0.060)	0.041	(0.077)	0.050	(0.078)
Openness	-0.015	(0.061)	-0.056	(0.072)	-0.033	(0.071)
Conscientiousness	0.102	(0.062)	0.083	(0.075)	0.084	(0.090)
Extraversion	0.105+	(0.056)	0.100	(0.062)	0.094	(0.063)
Agreeableness	-0.170*	(0.067)	-0.192*	(0.077)	-0.207**	(0.078)
Age first birth	0.253*	(0.102)	0.108	(0.132)	0.037	(0.143)
$(\text{Age})^2/1000$	-4.743**	(1.737)	-1.990	(2.210)	-0.991	(2.405)
University degree	0.647**	(0.137)	0.736**	(0.161)	0.671**	(0.170)
Vocational degree			*Omitted category*			
No degree	-0.237+	(0.129)	0.081	(0.162)	0.120	(0.161)
Experience	0.027	(0.018)	-0.015	(0.022)	-0.023	(0.022)
log(Other income)	-0.736**	(0.092)	-0.619**	(0.125)	-0.652**	(0.117)
Partner in HH	0.657**	(0.190)	0.452+	(0.239)	0.511*	(0.234)
Other adults in HH	1.192**	(0.225)	0.056	(0.663)	0.487	(0.538)
East Germany	0.091	(0.102)	0.390**	(0.140)	0.545**	(0.148)
Migration background	-0.512**	(0.137)	-0.094	(0.179)	-0.113	(0.202)
Health	0.140*	(0.057)	0.091	(0.070)	0.105	(0.073)
2^{nd} child w/in 4 yrs	-0.316**	(0.097)	-0.432**	(0.116)	-0.462**	(0.115)
3^{rd} child w/in 6 yrs	-0.338+	(0.179)	0.051	(0.231)	0.012	(0.314)
log(Prior wage)					0.521**	(0.155)
Constant	-3.767*	(1.639)	-1.588	(2.175)	-1.360	(2.254)
Log likelihood	-2876.87		-2130.14		-2124.40	
No. of person-month obs	23736		15122		15122	
No. of individuals	906		666		666	

Note: the results in column 1 refer to the full sample, those in column 2 and 3 refer to the reduced sample of women who have been employed prior to childbirth. All models include dummies for the year of first childbirth as well as duration dependency dummies as described in Section 4. Standard errors are in parentheses. + p<0.10, * p<0.05, ** p<0.01. Author's calculations with data from the SOEP 1994-2007.

The proportional hazard model implies that the effects of the covariates on the hazard

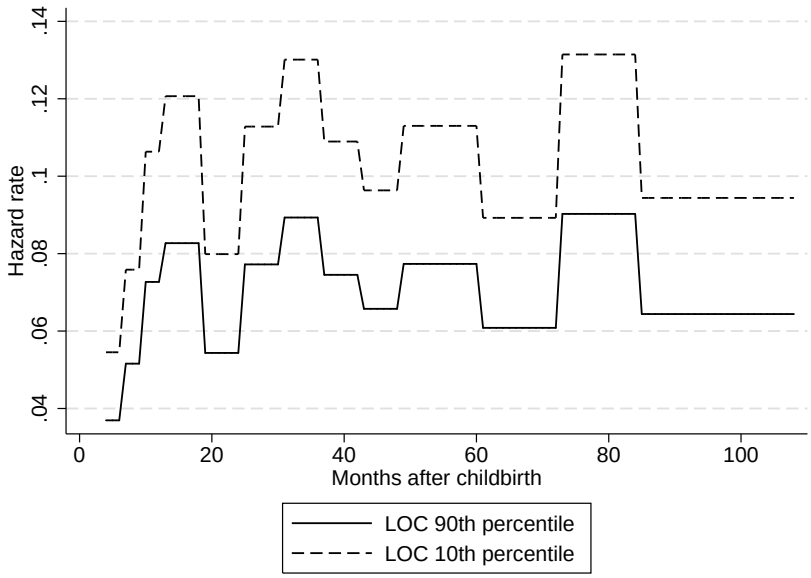
are proportional and do not depend on the duration j. Hence, one-standard deviation decrease in the LOC score (decrease by 0.602 points) leads, ceteris paribus, to an increase in the hazard rate to return by 17 percent according to the results in column 3 of Table 4. Moving from the 90th percentile of LOC to the 10th percentile increases the hazard rate by 47 percent. This increase in the hazard rate is almost as high as the difference in the hazard rate between a woman with and a woman without a partner or the difference between a woman in eastern and a woman western Germany.

To illustrate the result, Figure 1 plots the hazard functions for two persons who are equal in all characteristics but LOC.[8] The step pattern of the graph is a result of modeling duration dependency by groups of months, as has been exposed in Section 4. The first peak of the hazard function is at the time span of months 13 to 18 suggesting that many women enter employment in the first half of the second year after childbirth. The second peak can be observed in the graph at months 31 to 36, that is, in the second half of the third year after childbirth. This appears very plausible as the legal right to return to the previous job vanishes after three years and many women thus return before this end. The last peak of the hazard function is observed when the child is six years old, which is the usual school entry age in Germany. The irregular pattern of the hazard function confirms the importance to model duration dependency non-parametrically.

The solid line in the graph relates to a person with high external LOC (90th percentile), the dashed line to a person with low LOC (10th percentile). The solid line is always below the dashed line, which illustrates that a person with high external LOC is less likely to return to employment in each period, given that she has not returned until this period.

The result can likewise be illustrated by survival functions. Figure 2 shows the survival functions for two persons with 90th-percentile LOC (solid line) and 10th-percentile LOC (dashed line), respectively. The former is always above the latter, indicating that a woman with a highly external LOC is more likely to remain outside the labor force until a given period than a person with a more internal LOC. The probability to return to employment within twelve months after childbirth, for instance, is 39 percent for a person with a LOC score at the 90th percentile, while it is 52 percent for a person with an LOC score at the 10th percentile. The numbers appear fairly high, this is due to the selection of the sample. Recall that it includes only women who were employed before childbirth and also exclude those who enter unemployment after childbirth. The median return time for a person with a LOC score at the 90th percentile is estimated to be 14 months, while the median return time for a person with a LOC score at the 10th percentile is 12 months.

[8]For the graph, all non-binary covariates other than Agreeableness are set to their mean, (sets of) dummy variables are set to their modal value, that is, vocational degree for education, having a partner, no other adults living in the household, living in western Germany, no migration background, no second child within four years, no third child within six years. Changing these covariates would not change the pattern of the graph but only be rescale it, this is due to the proportional hazard feature of the model.

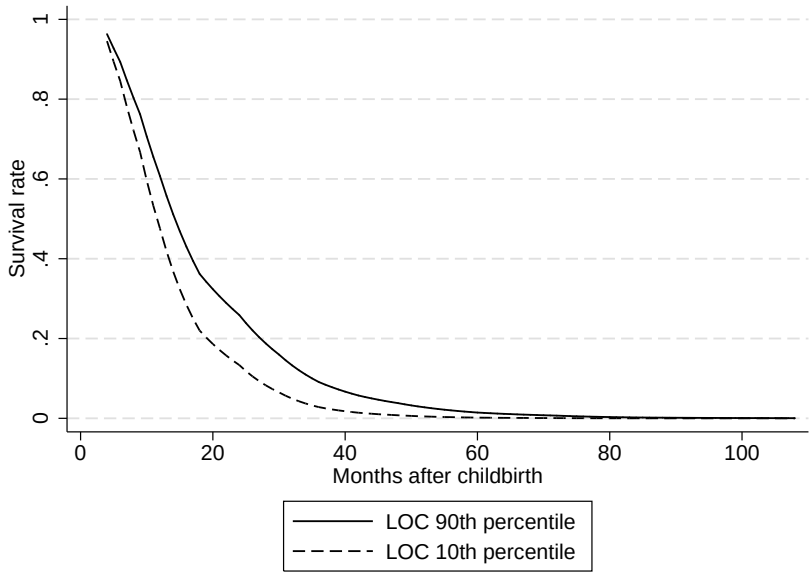


Note: the estimated parameters of model 3 of Table 4 are used. All non-binary covariates other than LOC are set to their mean, the (sets of) dummy variables are set to their modal value, that is, vocational degree for education, having a partner, no other adult living in the household, living in western Germany, no migration background, no second child within four years, no third child within six years.

Figure 1: Hazard functions for two persons with different levels of LOC

The result confirms the expectation saying that women with a more internal LOC return to employment earlier. This might be due to their greater willingness to invest in human capital or to their greater resoluteness when looking for solutions to combine work and family. In Section 2.1, I outlined another explanation as to why individuals with a more external LOC might return to employment later. This third explanation refers to the association between LOC and job search intensity as found by Caliendo, Cobb-Clark, and Uhlendorff (2009). However, this explanation does not apply for the findings here as will be shown by the robustness tests discussed in Section 6.

Concerning the Big Five personality traits, the three models in Table 4 suggest that highly agreeable women (re-)enter employment later than less agreeable women. This is found for the full sample as well as for the reduced sample and even when prior wage is controlled for. Thus, the reason for the negative effect of Agreeableness on the hazard rate to return cannot exclusively be due to the fact that more agreeable individuals earn less — which has been found by Cebi (2007) and Heineck and Anger (2010) — but there seems to exist a direct effect on the labor supply decision of mothers. One-standard deviation decrease in the Agreeableness score (decrease by 0.709 points) leads, ceteris paribus, to an increase in the hazard rate by 16 percent according to the results in column 3 of Table 4. Moving from the 90th percentile of Agreeableness to the 10th percentile increases the



Note: the estimated parameters of model 3 of Table 4 are used. The covariates other than LOC are set analogously to Figure 1.

Figure 2: Survival functions for two persons with different levels of LOC

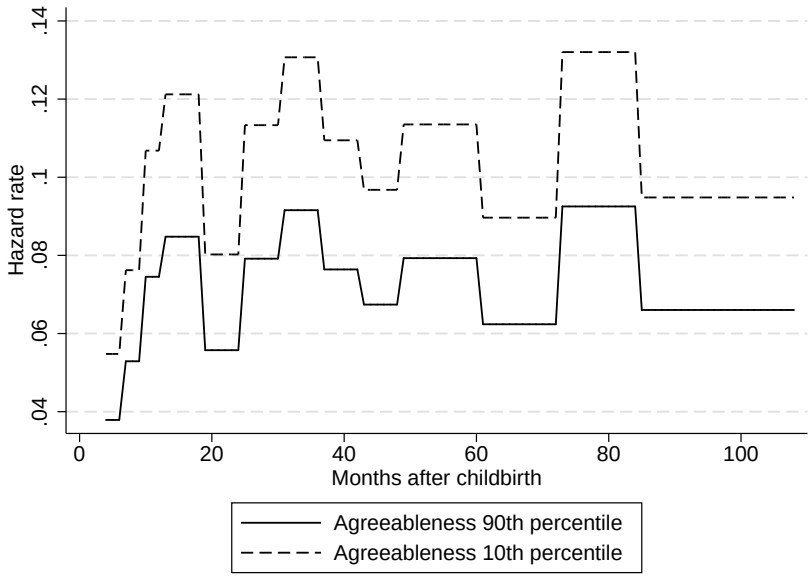
hazard rate by 46 percent. Analogously to the effect of LOC, the effect of Agreeableness on the hazard and survival functions is illustrated by the graphs in Figures 3 and 4, respectively. The person with high Agreeableness (90th percentile) has always a lower hazard rate and a higher survival rate than the person with a low score on Agreeableness (90th percentile). The probability to return to employment within twelve months after childbirth is 40 percent for a person with an Agreeableness score at the 90th percentile, while it is 47 percent for a person with an Agreeableness score at the 10th percentile. The median return time for a person with an Agreeableness score at the 90th percentile is 14 months while the median return time for a person with an Agreeableness score at the 10th percentile is 12 months.

6 Robustness tests

In a first series of robustness tests, I estimate the model with a parametrically specified random effect. Given that the hazard function is

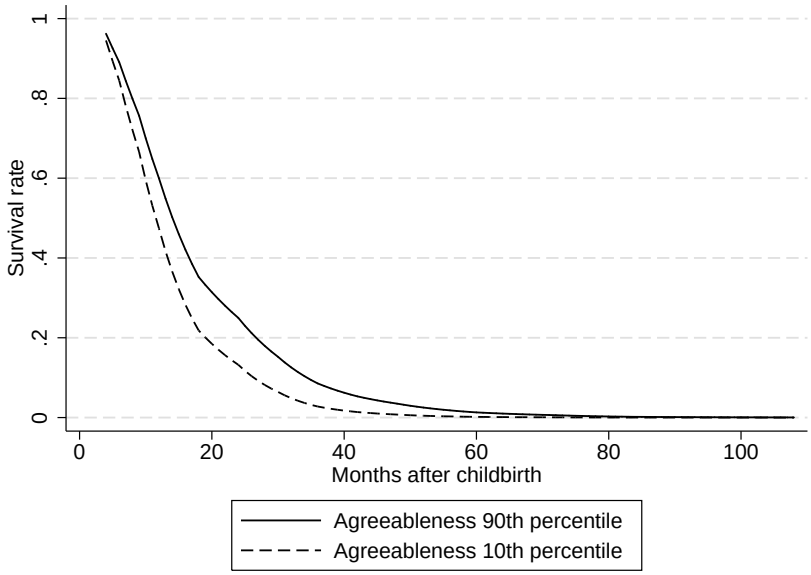
$$h(j, X) = 1 - \exp[-\exp(\gamma_k D_k + \beta' X + u)],$$

where u is an individual effect and $u = log(v)$, I estimate, first, a model with v Gamma-distributed, second, a model with u Normal distributed with mean zero, and, third, a



Note: the estimated parameters of model 3 of Table 4 are used. The covariates other than Agreeableness are set analogously to Figure 1.

Figure 3: Hazard functions for two persons with different levels of Agreeableness



Note: the estimated parameters of model 3 of Table 4 are used. The covariates other than Agreeableness are set analogously to Figure 1.

Figure 4: Survival functions for two persons with different levels of Agreeableness

model with $u = 0$, that is, no individual effect. The results of the three estimations are reported in Table 5 (dropping the covariates from the table). All estimations refer to the reduced sample including hourly wage as a control variable. Note that there is no change in the sign and significances compared to the estimations in column 3 of Table 4. However, the magnitude of the coefficients is different being much larger when u is assumed Normally distributed and slightly smaller when no random effect is assumed to exist. The main model of assuming no parametric distribution for the random effect, as in the estimations in Table 4, is definitely the most flexible and thus the best specification of estimating employment transitions.

Table 5: Estimation of transition to employment by a discrete hazard model with distributional assumptions for the random effect

	(1) v Gamma distributed		(2) u Normal distributed with mean zero		(3) $u = 0$ (no random effect)	
	b	se	b	se	b	se
LOC	-0.309*	(0.130)	-0.717**	(0.258)	-0.220**	(0.084)
Neuroticism	0.118	(0.103)	0.302	(0.203)	0.073	(0.073)
Openness	-0.051	(0.100)	-0.178	(0.197)	-0.050	(0.067)
Conscientiousness	0.078	(0.100)	0.223	(0.203)	0.079	(0.075)
Extraversion	0.121	(0.098)	0.302	(0.197)	0.080	(0.065)
Agreeableness	-0.202+	(0.106)	-0.435*	(0.213)	-0.159*	(0.076)
Constant	0.830	(3.323)	7.493	(5.971)	-2.418	(2.100)
Log likelihood	-2160.06		-2136.09		-2163.05	
No. of person-month obs	15122		15122		15122	
No. of individuals	666		666		666	

Note: all models include the same control variables as model 3 of Table 4 though not all coefficients are reported here. Standard errors are in parentheses. + p<0.10, * p<0.05, ** p<0.01. Author's calculations with data from the SOEP 1994-2007.

Above, I argued that the finding of individuals with internal LOC returning to employment earlier might be due to their greater willingness to invest in human capital and their greater resoluteness when looking for solutions to combine work and family. However, there might be the concern that individuals with a more internal LOC search more intensively for a job and therefore return earlier to employment. Also, certain noncognitive traits might be rewarded on the labor market in the way that women with these traits more easily find a new position after the period of child-related leave. However, since mothers in Germany are usually entitled to return to their previous job within three years after childbirth, these explanations would be only applicable for women who are not able to return to their previous job position as they had only a temporary contract which expired in the meantime. Removing from the sample all individuals who had a temporary job prior to childbirth would then make disappear the effects of the noncognitive traits on

the time to return. This is tested including in the sample only individuals who have been employed on a permanent basis prior to birth and, further, considering only the period within the first three years after childbirth. The results of the estimation can be found in column 1 of Table 6. The sample is reduced to 471 individuals with a total of 7382 person-month observations. It emerges that the results remain largely robust and similar in magnitude compared to the main model.

Another reason why to find a relationship between noncognitive traits and the transition to employment might be that women with certain noncognitive traits select themselves into specific job types, for example civil service, and these job types are at the same time more compatible with long child-related leaves. If this is the case, the noncognitive traits would not directly affect the choice to stay out of the labor force, but rather indirectly through the choice of the job. To check this possible channel, I introduce into the model a set of variables for the job type (civil servant, self-employed, white collar worker, blue collar worker) and also for the working hours categories (full-time, part-time, marginal hours) of the job prior to childbirth. The results with these additional covariates are reported in column 2 of Table 6. Although it emerges that some of the variable have an additional predictive power — self-employed women appear to return to employment much earlier — the estimated effects of LOC and Agreeableness stay similar to the results in the main model. The coefficients even increase in absolute value.

A third robustness test refers to the concern of endogeneity of the noncognitive measures with the birth. So far, I had to assume that the noncognitive traits are constant over time for each individual. This is necessary because the Big Five personality traits and this version of the LOC have been surveyed only in the 2005 wave. However, there might be the concern that if a women has a child with poor health and this makes her adopting a more external LOC and at the same time the sick child makes her return to employment later because she wants to care for the sick child, the results are biased. The main problem about this issue is that most births in the sample occur before 2005 and thus before the noncognitive traits are surveyed. Therefore, it cannot excluded that the characteristics of the child affect both the noncognitive traits and the time until return to employment. However, I am able to carry out a robustness test with respect to LOC since the items of the 2005-LOC have been surveyed already in 1999. The difference is that the answer scores are in 1999 on a 4-point scale rather than on a 7-point scale, which is the reason why the two LOC-versions, 1999 and 2005, cannot be combined in one measure. In the robustness test, I substitute the 2005-LOC with the 1999 version of the LOC and reduce the sample to those women who have had their first child after 1999 in order to make sure that the characteristics of the child or of the birth cannot influence the LOC score. Doing this, the sample is strongly reduced and only 246 individuals with 4316 person-month observations are left. This is the reason why it is not possible to

estimate the above mixed model. But I have shown above that the models incorporating a parametrically specified random effect produce similar results. The Big Five personality traits cannot be included in the estimation since this would reduce the sample to an even smaller size. Also, this would again bias the results as the Big Five traits have been surveyed in 2005 which for most women is after their first childbirths. Removing the Big Five personality variables from the main model, however, does not change substantially the effect of LOC-2005 on the hazard rate. The results using the 1999-LOC are reported in column 3 of Table 6 (model with v Gamma distributed[9]). The coefficient related to LOC is negative and significant as in the main model, only the magnitude of the effect is much larger in absolute terms, but the standard error is also much higher due to the reduced sample size. This shows that the previously estimated effects cannot be attributed to an endogeneity effect through birth.

Another concern for the robustness of the result refers to assortative mating of partners. One could think of partners matching according to certain patterns of personality traits and at the same time the traits of the partner might play a role for the labor supply of the woman. For example, one could think of less agreeable women being more likely to mate with highly agreeable partners and this agreeableness of the partner, being likely to resign from his own career ambitions, might be the reason why these less agreeable women return to employment shortly after childbirth. Although the psychological literature suggests that there is no or very little assortative mating on personality traits, the issue is addressed by running a regression which additionally includes a set of variables for the partners' noncognitive traits. This reduces the sample to 525 individuals since only women who have a partner and whose partners' noncognitive traits are observed can be included in the estimation. The results are reported in column 4 of Table 6. No significant effect of the partners' noncognitive traits on the time until return to employment can be identified. The sign and magnitude of the effects of the woman's LOC and Agreeableness are largely the same as in the main estimation. Only, the coefficient of LOC is significant only on the p=10.4% level.

[9]The results of a model with u Normal distributed and of a model without a random effect are similar.

Table 6: Estimation of transition to employment by a discrete hazard model with a discrete mixture distribution to summarize unobserved heterogeneity — several robustness estimations

	(1)		(2)		(3)		(4)	
	coef	se	coef	se	coef	se	coef	se
LOC	-0.272*	(0.121)	-0.426**	(0.158)			-0.222	(0.136)
LOC 1999					-1.433**	(0.534)		
Neuroticism	0.115	(0.114)	0.231+	(0.139)			0.020	(0.114)
Openness	-0.019	(0.208)	-0.199	(0.144)			0.047	(0.094)
Conscientiousness	-0.027	(0.095)	0.067	(0.103)			0.165	(0.101)
Extraversion	0.110	(0.092)	0.193+	(0.114)			0.001	(0.078)
Agreeableness	-0.276*	(0.111)	-0.243*	(0.108)			-0.294**	(0.098)
Full-time			*Omitted category*					
Part-time			-0.278	(0.250)				
Marginal hours			-0.931	(0.574)				
Civil servant			0.049	(0.232)				
Self-employed			1.752**	(0.621)				
White-collar worker			*Omitted category*					
Blue-collar worker			-0.309	(0.199)				
Partner's LOC							-0.019	(0.031)
Partner's Neuroticism							0.042	(0.036)
Partner's Openness							-0.029	(0.037)
Partner's Conscientiousness							-0.026	(0.043)
Partner's Extraversion							0.007	(0.048)
Partner's Agreeableness							0.037	(0.033)
Constant	2.292	(5.348)	-0.541	(4.142)	9.216	(10.222)	1.950	(2.992)
Log likelihood	-2147.39		-1203.43		-707.04		-1720.25	
No. of person-month obs	15122		7382		4316		12268	
No. of individuals	666		471		246		525	

Note: all models include additionally the same control variables as model 3 of Table 4 though not all coefficients are reported here. Standard errors are in parentheses. + p<0.10, * p<0.05, ** p<0.01. Author's calculations with data from the SOEP 1994-2007.

7 Conclusions

This paper analyzed the role of noncognitive traits in the duration of mothers' career breaks after first childbirth. Using data from the German Socio-Economic Panel Study (SOEP), I estimated a discrete semi-parametric survival model incorporating a discrete mixture distribution to summarize unobserved individual heterogeneity. The results indicate that external LOC and the Big Five trait Agreeableness are both positively related to the length of the period of child-related non-participation. The sign of the effect of LOC confirms expectations according to which individuals with an internal LOC are more likely to invest in human capital and thus in labor market experience because they expect higher returns in terms of future earning. Also, women with an internal LOC are more likely to make an effort to reconcile work and family life because they are more confident to find a solution in this matter. The finding for the trait Agreeableness is consistent with the expectation that agreeable women tend to be altruistic towards their spouse and are more likely to resign from their own career ambitions. Another explanation for the relationship would be that agreeable women tend to avoid the work-family conflict and that they are more inclined to accept the traditional social norms and family patterns.

Although there are no direct policy implications from this research, it is important to understand the mechanisms that influence mothers' labor supply decisions before designing policy measures. Since noncognitive traits are not determined from birth but develop especially during adolescence and are influenced by a number of surrounding factors like education, it is important to understand the consequences these traits have on later outcomes.

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