Earnings Instability and Tenure

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Abstract

Previous literature has established that both displacement and voluntary job changes affect the earnings variance. This paper develops a tractable empirical approach to estimate the effect of on-the-job tenure on the permanent and the transitory variance of earnings. The model is also used to evaluate earnings instability associated with fixed-term contracts (short-tenure contracts) in Italy. Our results indicate that each year of tenure on the job reduces earnings instability by 13%. Workers on a fixed-term contract on average have an earnings instability 2-3 times higher than workers on a permanent contract. Workers who spend their entire working life on fixed-term contracts can expect an earnings instability 5 to 6 times higher.

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1 Introduction

Estimating the changes in the variance of earnings is the topic of the large literature on earnings inequality and mobility. Typically the individual earnings variance over time is studied as the sum of a permanent component (which has to do with changes in the quantity and prices of permanent individual characteristics) and a transitory component.

Gottschalk and Moffitt (1994) were the first to focus on the growth of earnings instability i.e. the increasing variance of the transitory component of earnings. They argued that the increase in the variance of the transitory component of earnings has been an important contributor to the increase in overall earnings inequality in the US. Subsequent research extended Gottschalk and Moffitt's approach to several countries, including Italy (see Cappellari, 2004). However, while the evolution of earnings instability has been described for many countries, little is known about its causes.

This paper looks at the effects of tenure on earnings variance in both the permanent and the transitory components. It is intuitive that the accumulation of tenure on the job affects the permanent component of earnings. It is also plausible that the frequency of voluntary and involuntary job moves and the wage changes in consequence of the change also affect the transitory variance of earnings. Many workers move through a series of short jobs and short tenure with the associated periods of job search on and off the job may imply more volatile earnings.

Previous literature has established that both displacement (Huff-Stevens 2001) and voluntary job change (Leonardi 2004) affect the transitory variance of wages. This paper models explicitly the role of tenure and studies the effect of tenure on the permanent and the transitory variance of earnings.[1] In particular we study the diffusion of fixed term contracts in Italy and their impact on the earnings variance. Fixed-term (also called temporary contracts) contracts are short tenure contracts which typically last two or three years and can be renewed only once. In consequence of changes in labor market legislation, they spread in many European countries in the nineties. A large literature has studied the effect of fixed-term contracts on employment, unemployment and job flows but nobody has looked so far at their effects on earnings instability. Yet one of the main concerns in the popular press and among policy makers is the earnings instability associated

[1] We use the term permanent variance to indicate the variance associated to permanent individual characteristics, even if at times we will model it with a time-varying process. Equivalently the term transitory refers to a mean-reverting process which can be serially correlated.

with fixed-term contracts. Earnings instability is crucial in welfare evaluation because is strictly related to the uncertain and uninsurable component of earnings. In this paper, we study the earnings instability associated with a fixed-term contract conditional on employment.[2]

We ask two questions. First, can we quantify the effect of tenure on the permanent and transitory variance of earnings? Secondly, how different is average earnings instability of an individual who works on a permanent contract with respect to somebody who has worked at any time on a fixed-term contract? and with respect to somebody who has worked on temporary contracts his entire working life?

Our results indicate that workers with five years of tenure have on average an earnings instability three times lower than workers with zero years of tenure or in other words each year of tenure on the job reduces earnings instability by 13%. Workers on fixed term contract on average have an earnings instability 2-3 times higher than workers on permanent contracts. But workers who spend their entire working life on temporary contract can expect a earnings instability between 5 and 6 times higher than sombody on a permanent contract. Although temporary contracts are associated with significantly higher earnings instability, they can explain very little of the evolution of average earnings instability because the absolute number of workers on fixed-term contracts remains small (they reach 10% of all contracts only in the young cohorts).

The rest of the paper proceeds as follows. Section 1 describes the data with particular attention to the evolution of average tenure on the job and the diffusion of fixed-term contracts in Italy. Section 2 explains the statistical model. Section 3 describes the results and section 4 concludes.

2 Data Description

The dataset is drawn from the Italian Social Security Administration (INPS) archives and spans the years 1986-1996. The original dataset collects social security records of a 1/90 random sample of employees born on the 10th of March, June, September, and December of every year. The original archives only include information on private sector firms in the manufacturing and service sectors, therefore all workers in the public sector, agriculture and self-employment are excluded. We use a 10% random sample from the original

[2] Clearly part of earnings instability associated with fixed-term contracts may be due to instability in the employment status. We leave the analysis of employment instability for further work.

dataset.

The dataset includes individual longitudinal records generated using social security numbers. However, since the INPS collects information on private sector employees for the purpose of computing retirement benefits, employees are only followed through their employment spells. The dataset stops following individuals who move into self-employment, the public sector, the agricultural sector, the underground economy, unemployment and retirement.

The data includes information on employees' age, gender, occupation (blue collar-white collar), yearly earnings, number of paid weeks, the exact date of start and end date of a contract and the type of contract (permanent-temporary). The dataset also includes longitudinal records for firms employing the randomly selected workers in the sample using the firms' name, address, social security and fiscal codes and information on firms' location, sector of employment and average number of employees.

Crucial for this paper, we have exact information on tenure on the job (number of days since the start of the contract) and we can define firm changers making use of the firm identifier, however we do not know whether they are quits or layoffs. Furthermore we have information on the type of contract (permanent or fixed-term).

2.1 Sample selection rules

We keep in the sample all male workers age 20 to 55 with a positive yearly earnings. We also eliminate few observations where the daily earnings (the yearly earnings divided by the reported days of work) is larger than the yearly earnings. In the course of the paper we use weekly earnings (yearly earnings divided by the number of weeks paid). For the cases of multiple individual spells in the same year we keep only the longest spell.

The administrative data in electronic form start the 1st of January 1985 and the start date of all contracts already running at that date are artificially set to zero at January 1st. We drop all those zeros because we are not able to establish the exact tenure on the job of all those workers whose contracts started before the1st of January 1985. Thus we consider only tenures which started after the 1st of January 1985. We further drop year 1985 because of a flaw in the earnings records, the final dataset includes 9482 individuals with around 46,900 person-year observations over the years 1986-1996.[3]

[3] At the time of writing we are expecting to receive the extension of the sample to 2001. This will potemtially make our results more interesting beacuse 1997 is the year of the boom of fixed-term contracts in Italy and possibly of a further change in average tenure.

We will identify the effect of tenure on the permanent and transitory earnings variance modelling the covariance structure of earnings within cohort. The following descriptive statistics focuses on the tenure profiles of individuals belonging to different cohorts. Additional descriptive statistics on the covariance structure of earnings can be provided upon request.

2.2 Descriptive statistics on tenure

We consider three cohorts of individuals: those born between 1940 and 1949, those born between 1950 and 1959 and those born between 1960 and 1969. Table 1 shows the average tenure in days in the full sample and within each cohort. The last row of the table shows the total number of observations in each cohort and in the full sample.

The table shows a large variation in average tenure both between and within cohorts. All cohorts start with low average tenure in 1985 because the average refers only to contracts started after January 1st 1985. Older cohorts (those born between 1940 and 1949) accumulate on average longer tenure between 1986 and 1996 because older workers tend to change jobs less frequently. Younger cohorts (born between 1960 and 1969) accumulate less tenure because workers at the beginning of their careers tend to change jobs more often. In 1996, after 11 years, the difference between average tenure of the cohort born 1940-49 and the younger cohort born 1960-1969 is 235 days or around 8 months. The average tenure in 1996 is 2059 days (6.8 years considering 300 working days per year) for the oldest cohort and is 1824 days (6 years) for the youngest cohort.

Looking at changes within cohort, the accumulation of tenure occurs more rapidly for the oldest cohorts and less rapidly for the youngest cohort, however average tenure appears to cumulate linearly in time within all cohorts. This will be a concern in the joint identification of time and tenure effects on the permanent and transitory variance of earnings.

The last important thing to notice is that the diffusion of fixed-term contracts contributed to lowering the accumulation of tenure in the youngest cohort. Table 2 shows the average tenure by type of contract only for the cohort born between 1960 and 1969 (the previous cohorts have a much lower presence of fixed-term contracts). The average share of fixed-term contracts is a little less than 10% of the total number of contracts in the years 1985-1996. The share of fixed-term contracts is around 20% of the total in the years 1988-1991, when the average age of the cohort is between 25 and 26, and declines to 5% of the total in the later years as the cohort ages and many workers move to permanent contracts. The average tenure of a worker on

Table 1: Average tenure in days

	Average Tenure in Days				
Year	Cohort born 1940-49	Cohort born 1950-59	Cohort born 1960-69	Full Sample	N obs.
1985	193	195	192	194	1164
1986	398	396	377	389	1944
1987	596	581	533	566	2532
1988	798	756	679	735	3153
1989	977	914	776	871	3629
1990	1143	1078	901	1016	3897
1991	1277	1205	1026	1146	4496
1992	1511	1411	1211	1350	4648
1993	1631	1541	1371	1492	5155
1994	1797	1689	1572	1667	5260
1995	1898	1775	1686	1767	5555
1996	2059	1933	1824	1914	5461
Total N obs.	11887	14972	20035		46894

a fixed-term contract is around 600 days (or 2 years), between one half and one third of the average tenure of a worker in a permanent contract.

In this paper we investigate whether tenure has a significant effect on the transitory (and the permanent, but this is more obvious) variance of earnings. We want to quantify how much more volatile are on average the earnings of somebody with low tenure with respect to somebody with high tenure (say five years of tenure). If this is the case we want to quantify how much more unstable are the earnings of somebody on a fixed-term contract with respect to somebody on a permanent contract. To do so we need to model the effect of tenure (and of fixed-term contracts directly) on the transitory component of earnings.

Table 2: Average tenure in days by type of contract: Cohort born 1960-1969.

Year	Permanent Contracts	N obs.	Fixed-term Contracts	N obs.
1985	192	446	197	56
1986	381	623	357	119
1987	545	823	477	181
1988	723	1036	510	271
1989	848	1204	529	350
1990	962	1463	559	262
1991	1072	1756	639	207
1992	1247	1892	621	117
1993	1406	2108	606	97
1994	1613	2150	566	87
1995	1736	2284	643	109
1996	1876	2294	630	100
Total N obs.		18079		1956

3 Statistical Model

We characterise the link between earnings instability and tenure by modelling the intertemporal covariance structure of earnings. Specifically, by using panel data on individuals, we are able to separately identify a long-term earnings component and a mean-reverting one. We define earnings instability as the dispersion of mean reverting earnings shocks, i.e. that part of earnings inequality that fades away over time.

Our data enable us to observe several birth cohorts over the sample period and gives us the possibility to separate time and birth cohort effects estimating the within-cohort earnings covariance structure. In particular, let w_{ict} be the deviation of log-earnings for individual i in cohort c and year t from the cohort and period specific mean, with $i = 1, ..N_c$, $t = 0, ..10$, and c=1940-49, 1950-59, 1960-69. Earnings differentials within each cohort can be analysed by modelling the earnings covariance structure $E(w_{ict}\ w_{ic(t-k)})$, $k = 0, ..10$.

3.1 Basic model

We start by characterising the benchmark decomposition of earnings differentials between earnings instability and long-term persistence. The aim of this first step is to describe the evolution of the variance components over time. Later we introduce on-the-job tenure.

Let w_{ict} be the sum of two orthogonal components, the long-term one (w^P_{ict}) and a mean-reverting shock (w^T_{ict})

$$w_{ict} = w^P_{ict} + w^T_{ict}; \qquad E(w^P_{ict} w^T_{ict}) = 0 \tag{1}$$

The first component represents those earnings determinants that depend on long-term personal attributes such as education or learning ability on-the-job; the second component captures in each year the deviations of individual earnings from the person-specific long-term component. The orthogonality assumption allows separate identification of the two components.

In this basic set-up, we allow long term earnings to depend upon an idiosinctratic term μ_i, which is shifted by a period-specific loading factor π_t (π_0 is normalized to one) and a cohort specific loading factor λ_c (λ_{1940} is normalized to one for identification):

$$w^P_{ict} = \lambda_c \pi_t \mu_i; \qquad \mu_i \rightsquigarrow iid(0, \sigma^2_\mu) \tag{2}$$

Period-specific loading factors account for aggregate shifts in the long-term earnings distribution, whereas cohort-specific ones control for the fact

that individual in different cohorts are observed at different stages of their life cycles, and within-cohort earnings inequality may reflect such differences. Given (2), the theoretical covariance structure of long-term earnings is

$$E(w_{ict}^P w_{ic(t-k)}^P) = \lambda_c^2 \pi_t \pi_{(t-k)} \sigma_\mu^2 \tag{3}$$

For the volatile component we assume a non-stationary AR(1) process, non-stationarity being allowed for by modelling the (variance of the) initial conditions of the autoregressive process:[4]

$$w_{ict}^T = \tau_t u_{ict}; \quad u_{ict} = \rho u_{ic(t-1)} + \epsilon_{ict}; \quad \epsilon_{ict} \rightsquigarrow iid(0, \sigma_\epsilon^2); \quad u_{ic0} \rightsquigarrow iid(0, \sigma_{c0}^2) \tag{4}$$

Again, period specific shifters (τ_t with τ_0 normalized to one) are allowed for in order to control for aggregate shifts. Cohort effects are modelled by assuming cohort-specific variances of initial conditions ($\sigma_{1940}^2, \sigma_{1950}^2, \sigma_{1960}^2$). These account for the fact that the accumulation of shocks up to the start of the sample period may differ depending upon the point of the life cycle at which an individual is observed. It follows that

$$E(w_{ict}^T w_{ic(t-k)}^T) = \tau_t \tau_{(t-k)} \left\{ \begin{array}{c} d_0 \sigma_{c0}^2 + d\left(\sigma_\epsilon^2 + E(u_{ic(t-1)} u_{ic(t-1)})\right) \rho^2 + \\ +(1 - d_0 - d) E(u_{ic(t-1)} u_{ic(t-k)}) \rho \end{array} \right\} \tag{5}$$

where $d_0 = I(k = 0, t = 1986)$, while $d = I(k = 0, t > 1986)$, $I(.)$ being an indicator function.

The orthogonality assumption given in 1 implies that the theoretical covariance structure of this model results from the sum of 3 and 5.

3.2 Modelling the impact of tenure

Our specific interest is in the impact of on-the-job tenure on earnings variance components. In principle, both components may vary with tenure, the first component because of differential learning ability on the job –say—and the second because of wage profiles stabilisation that can occur as individuals settle down in their jobs.

[4] We also experimented with ARMA(1,1) specifications. However, when we modelled the impact of tenure on instability, moving average components proved difficult to identify, possibly because much of the serial correlation in the volatile component was absorbed by the coefficient on tenure. For the sake of comparability, we therefore adopt the AR(1) specification throughout the paper.

To account for these effects , we augment the model of long term earnings with a random walk in job tenure:

$$w^P_{ict} = \lambda_c \pi_t v_{ijt}; \quad v_{ijt} = v_{ij(t-1)} + \phi_{ijt} \; ; \quad \phi_{ijt} \rightsquigarrow iid(0, \sigma^2_\phi) \tag{6}$$

v_{ijt} represents earnings at job j, which depend upon their past value in the same job, plus an idiosyncratic and serially independent innovation. Assuming the job started in period $h(< t-1)$, iterating the autoregression back to the start of the job yields $v_{ijt} = v_{ijh} + \sum_{s=h+1}^{t} \phi_{ijt}$ and thence:

$$E(w^P_{ict} w^P_{ic(t-k)}) = \lambda^2_c \pi_t \pi_{(t-k)} \left\{ \sigma^2_v + \min \left[E(tenure_{ict}), E(tenure_{ic(t-k)}) \right] \sigma^2_\phi \right\} \tag{7}$$

with $\sigma^2_v = var(v_{ijt})$. The model implies that the variance of the long term component grows linearly within a job, with slope coefficient given by the variance of innovations to the random walk process.

As for earnings instability, we model the impact of tenure by directly allowing the variance of innovations to depend upon it linearly:

$$\sigma^2_{\epsilon ct} = \alpha + \beta E(tenure_{ict}) \tag{8}$$

so that we exploit variation in average tenure across periods and cohorts to identify its impact on earnings instability. The expression in 8 therefore substitutes σ^2_ϵ to form the theoretical covariance structure of the volatile component in 5.

3.3 Modelling the impact of contract type

An alternative way to measure the relevance of firm seniority for earnings instability is to look at the type of contract, open ended or fixed term. The underlying idea is that fixed term contracts do not favour the accumulation of seniority. From a theoretical point of view, working on a fixed term contract may have an impact on each earnings component, say because of differential skill accumulation or exposure to economic fluctuations.

We allow for the effects of contract types by letting some of the parameters of the basic model depend upon the proportion of workers on fixed term contracts observed in a given cohort over time. More specifically we assume that

$$\sigma^2_{\mu ct} = \delta + \gamma E(g_{ict}) \tag{9a}$$

$$\sigma^2_{\epsilon ct} = \psi + \eta E(g_{ict}) \tag{9b}$$

where g_{ict} signals whether individual i from cohort c is on a fixed term contract in period t. The two parameters on the left hand side of 9a and 9b substitute their counterparts in 3 and 5 to form the theoretical covariance structure of long-term and volatile earnings components.

3.4 Estimation

We estimate the parameters of interest by imposing the restriction implied by the theoretical covariance structure models on empirical variances and covariances by minimum distance.

Let M_c be the empirical earnings covariance structure for cohort c, $m_c = vech(M_c)$ and $m = (m_{1940-49}, m_{1950-59}, m_{1960-69})$. The models discussed above imply that the theoretical covariance structure of all cohorts $E(w_{it}w_{i(t-k)})$ is a non linear function of a parameter vector: $E(w_{it}w_{i(t-k)}) = f(\theta)$.

We estimate θ by solving the following minimisation problem:

$$\min_{\theta}[m - f(\theta)]'A[m - f(\theta)]$$

where A is the identity matrix. Under some general conditions the estimator $\widehat{\theta}$ has asymptotic distribution $\sqrt{N(\widehat{\theta} - \theta)} \sim N(0, \Omega)$. The variance matrix $\Omega = (G'G)^{-1}G'VG(G'G)^{-1}$ can be estimated with the empirical counterpart of the gradient matrix $G = \frac{\delta f(\theta)}{\delta \theta}$ and of $V = var(m)$. In our tables of results we show the sum of squared residuals weighted by V^{-1} which, under the null of correct model specification has a χ^2 distribution with $198 - p$ degrees of freedom, p being the dimension of θ.

4 Results

We present five models, all models allow for three cohort effects in both the permanent ($\lambda_{1940} = 1, \lambda_{1950}, \lambda_{1960}$) and the transitory component ($\sigma^2_{1940}, \sigma^2_{1950}, \sigma^2_{1960}$) and model the transitory component with a parsimonious AR1. They differ in the way we gradually model the effect of tenure first in the permanent and then in both the permanent and the transitory component. We present in the text only the first descriptive model (model(1)) without tenure and the two final models of the effect of tenure: model (4) models explicitly the effect of tenure, model (5) models the effect of fixed-term contracts. We relegate the tables of the intermediate models (2) and (3) to the Appendix.

Model (1) is a model of fixed individual effect and AR1 (equation 2 and equation 4). We consider model (1) the benchmark description of the data

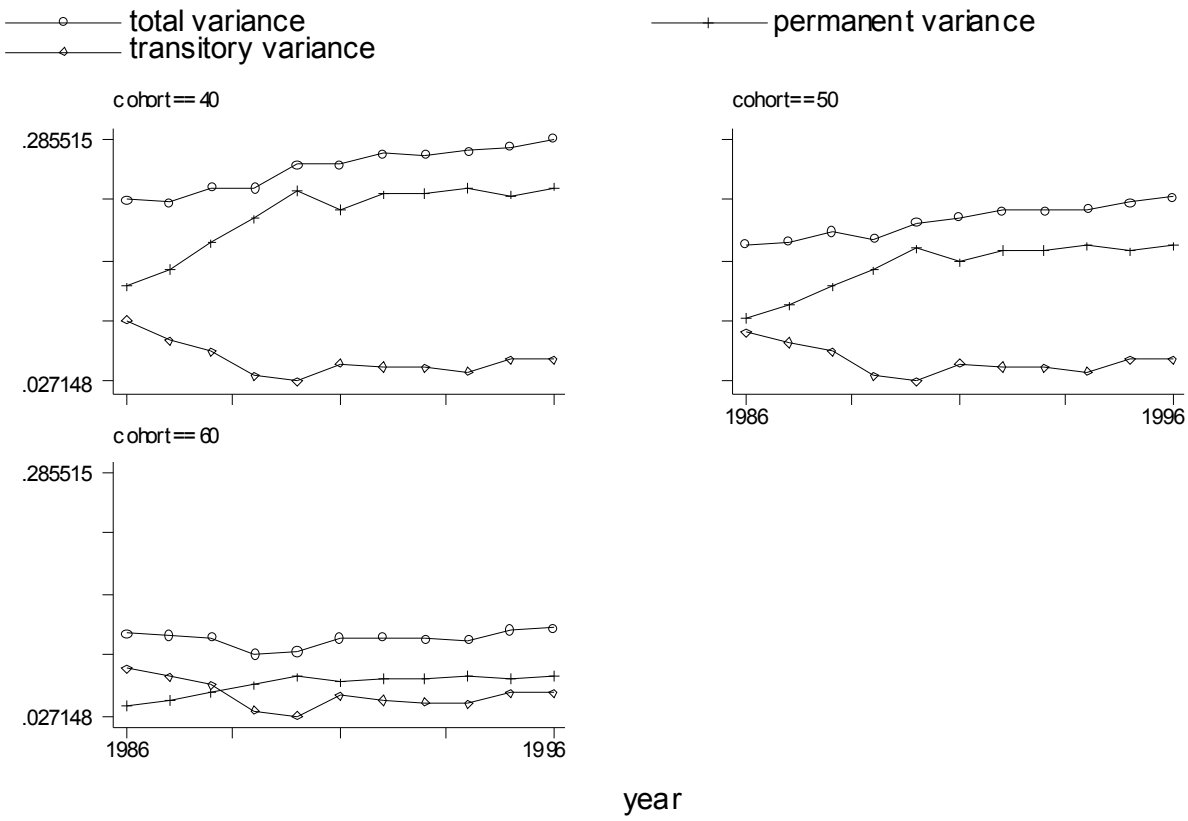

Figure 1: Variance Components by Cohort

before modelling the effect of tenure. We report the parameters in Table 7 in the Appendix. Figure 1 graphs of the predicted values of the permanent, the transitory and the total variance of wages. The figure shows a standard feature of higher variance for older cohorts and a growing permanent variance until the early 1990s. The transitory variance declines in the early period and is stable thereafter. These features of the covariance structure of earnings are in line with the results in Cappellari (2004).

Model (2) differs from model (1) because we model the permanent component as a random walk in age (equation 6 where v_{ijt} is a random walk in age not in tenure) and because we consider only four time shifters instead of 11 time dummies for each year in the sample. We estimate model

(2) (which still does not include tenure) for an easier comparison with the following models which include the effect of tenure. We need to reduce the number of time shifters (π_t and τ_t) to four (the first is normalized to one and the other three pool three years each) because of an identification problem of tenure and time dummies in the permanent component of wages.[5] The only effect of the four shifters is to impose linearity (within the three-years splines) in the permanent and the transitory components of earnings. Table 8 in the Appendix show the estimated parameters in the first column.

Model (3) models the effect of tenure on the permanent component (equation 6) but not in the transitory component of earnings. Table 8 in the Appendix shows the parameters in the third column. Model(3) differs from model (2) because the permanent component of the variance is modeled as a random walk in tenure instead of a random walk in age. The parameter σ^2_ϕ in Table 8 refers to the coefficient on age in the first column and to the coefficient on tenure in the third column. In the random walk in age the permanent variance grows linearly in age while in the random walk in tenure the permanent variance stops growing upon job change.

Comparing these results with those from model (1), we see that the patterns referring to the secular evolution of earnings variance components (permanent increasing, transitory decreasing) are confirmed. There is, instead, a lower degree of serial correlation ρ in the transitory component. Cohort shifters on the permanent component (λ_{1950} and λ_{1960}) in Model (2) differ from those estimated from Model (1): this is because Model (2) simultaneously looks at age, cohort and time effects, and the three are jointly identified only through parametric assumptions. What is more interesting is to compare the estimates of the random walk between Models (2) and (3). In the former case, the initial condition σ^2_v of the process is fixed at the start of the working career, while in the second it refers at the start of a job spell (that may be located at different places within the overall career). It is plausible that permanent earnings determinants are more homogeneously distributed at labour market entry than at the start of a job spell, and this is reflected in the larger variance of initial earnings in Model (3) compared with Model (2). Also, earnings growth σ^2_ϕ in Model (2) refers to average earnings growth over the entire life-cycle, whereas the corresponding pa-

[5] We have seen from Table 1 in the descriptive part that average tenure grows approximately in a linear way (albeit at different rates) within cohorts. This creates an identification problem when we want jointly identify the time shifters and the variance of the innovation of the random walk when the random walk is in tenure. It is enough to reduce the time shifters from 11 to four to achieve an easier identification.

rameter estimated in Model (3) refers to earnings growth over the first years in a job. Again, theoretical models of earnings dynamics can predict that the former is faster that the latter, and our results confirm such prediction.

4.1 A model of tenure

Model (4) introduces tenure in both the permanent and the transitory component of the variance. The permanent variance is a random walk in tenure while the transitory variance allows for a linear effect of tenure (measured in years=days/300) on the innovation of the AR1 (equation 6 and equation 8).

Table 3 shows the results of the estimation. The coefficient σ^2_ϕ=0.010(0.004) indicates that higher tenure increases the permanent variance of wages reflecting the higher heterogeneity in observed and unobserved permanent individual characteristics among long tenure workers. This may result from the differential accumulation of skills on the job or by the release of information upon the quality of the match in the presence of heterogeneous match quality. The coefficient β=-0.0084(0.0022) indicates that a higher tenure decreases significantly the transitory variance of wages. This effect indicates that earnings profiles stabilise as individuals settle down in their new jobs, and again may be interpreted in a matching model framework in which earnings profiles tend to their long term component as the quality of the match is revealed to employers.

Using the coefficients of the model we can predict the implied reduction in earnings instability when moving from zero years of tenure to five years of tenure. Table 4 shows the results of this exercise for the three cohorts on two different years, 1987 and 1994. Zero years of tenure imply a earnings instability around three times higher than five years of tenure. The results vary very little over time (the levels of instability are different but the difference between tenures are not) and are almost identical across cohorts. The reason of this result is that the cohort-specific effects (the cohort-specific initial conditions of the AR1 process $\sigma^2_{1940}, \sigma^2_{1950}, \sigma^2_{1960}$) are estimated at very similar values in Table 3.

Given that we model the transitory variance linearly in tenure, we can conclude on the basis of this result that each year of additional tenure implies a decrease of around 13%.[6] When compared to a permanent contract with average tenure of 5 years, a temporary contract of two years of tenure implies a earnings instability approximately twice as large.[7] To estimate the effect

[6] Obtained as (0.064-0.022)/(5*0.064)

[7] Compare earnings instability=0.022 of a permanent contract with 5 years of tenure

Table 3: A Model of Tenure

	Coefficient	Standard Error
σ_v^2	0.152926	0.016381
σ_ϕ^2	0.01063	0.004808
α	0.061809	0.008955
β	-0.00847	0.002257
σ_{1940}^2	0.066279	0.018247
σ_{1950}^2	0.057186	0.01773
σ_{1960}^2	0.066538	0.012503
ρ	0.209263	0.058156
λ_{1950}	0.746546	0.061784
λ_{1960}	0.316738	0.028913
π_1	1.109068	0.054463
π_2	1.102657	0.058484
π_3	1.100793	0.069847
τ_1	0.795801	0.090294
τ_2	1.005193	0.100507
τ_3	1.179646	0.203506
SSR	0.015066	
χ^2	460.6559	

of temporary contracts on earnings instability we can also think of modelling the effect of temporary contracts directly.

4.2 A model of fixed-term contracts

Model (5) is a model of the effect of fixed-term contracts on the earnings variance. A dummy equal one for a fixed-term contract enters linearly in the variance of both the permanent and the transitory component (equation 9a and equation 9b).

with a earnings instability=0.064-(0.064-0.022)*2/5=0.0472 for a temporary contract of two years of tenure.

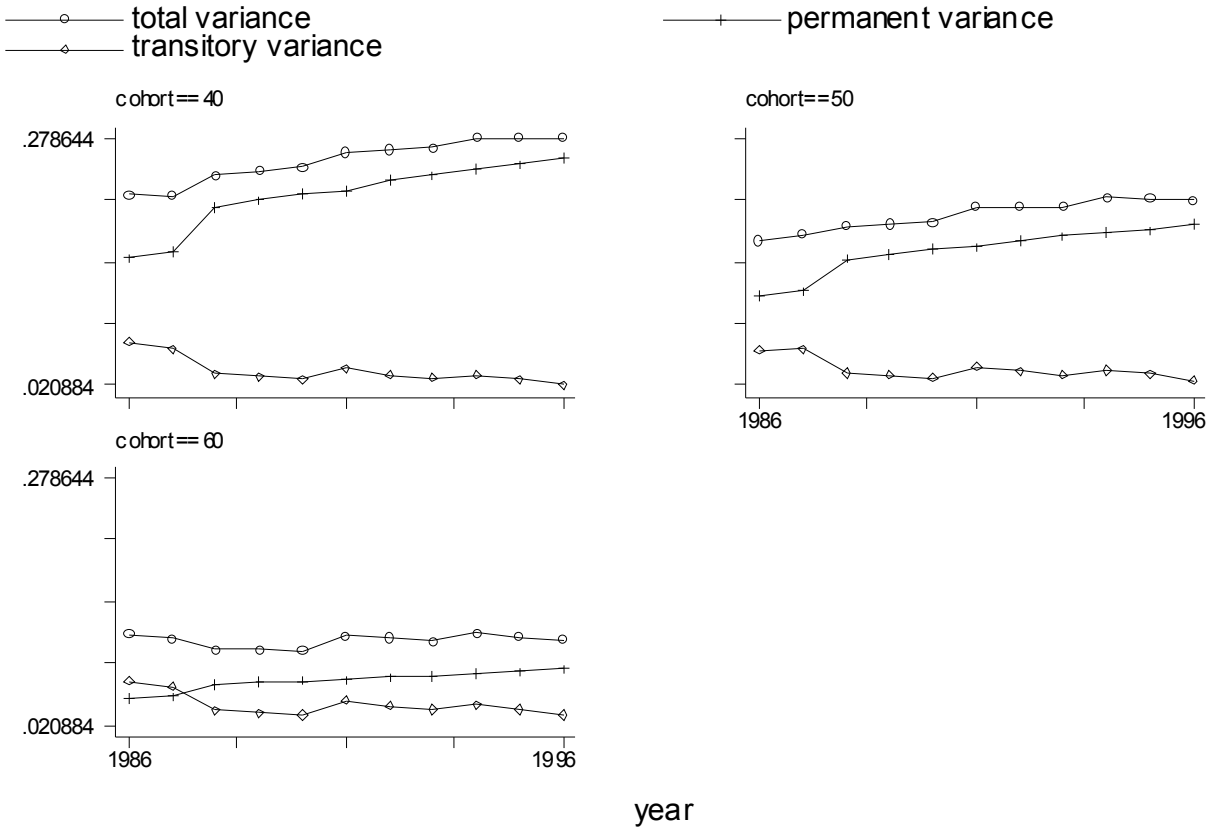

Figure 2: Variance Components: Model with Tenure

Table 4: Predicted Transitory Variance at Different Tenures.

	Cohort born 1940-1949	Cohort born 1950-1959	Cohort born 1960-1969
Year 1987			
tenure=0	0.06471	0.06431	0.06472
tenure=5	0.02234	0.02194	0.02235
Year 1994			
tenure=0	0.08995	0.08995	0.08995
tenure=5	0.02829	0.02828	0.02828

Table 5 shows the results of the estimation. We draw the attention on the values of the parameters γ=-0.603(0.344) and η=0.369(0.246) which indicate respectively the coefficients on the fixed term contract dummy in the permanent and in the transitory component. Individuals on fixed term contracts have on average a lower permanent variance of earnings and a higher transitory variance. The lower permanent variance probably reflects the lower heterogeneity of workers on fixed-term contracts in terms of age, education and of all observed and unobserved permanent characteristics, the higher transitory variance picks up the effect of the lower tenure (among other factors which are associated with a fixed-term contract and affect temporarily the wage).

On the basis of the coefficients in Table 5 it is possible to predict the average transitory variance of earnings in a given year for somebody on a permanent contract and compare it with the average transitory variance for somebody who is on a temporary contract with a probability given by the share of temporary contracts in his cohort in that year. It is also possible to predict the value of the transitory variance of somebody who is in a temporary contract with probability one i.e. somebody who has always been on temporary contracts all his work life.[8]

[8] In technical terms we impose η=0 to predict the transitory variance of a permanent contract, we weight η by the second moment of the dummy to predict the variance of a transitory contract and we weight η by one to predict the variance of somebody on a temporary contract for life.

Table 5: Model of Fixed-Term Contracts.

	Coefficient	Standard error
δ	0.127	0.023
γ	-0.603	0.344
ψ	0.067	0.029
η	0.369	0.246
σ^2_{1940}	0.096	0.019
σ^2_{1950}	0.092	0.018
σ^2_{1960}	0.106	0.018
ρ	0.398	0.038
λ_{1950}	0.728	0.062
λ_{1960}	0.294	0.026
SSR	0.008	
χ^2	512.188	

Note: The time shifters of the permanent and the transitory part are omitted.

We show the results of this counterfactual exercise in Table 6 divided by cohort in two different years at the beginning and at the end of sample, 1987 and 1994. The predicted value of the transitory variance of earnings on a temporary contract is not very different from the predicted value on a permanent contract for the two oldest cohorts (born in 1940-49 and in 1950-59). However the share of temporary contracts is very low in these cohorts. The results change for the cohort born in 1960-69 where the share of temporary contracts is on average 10% of the total and up to 20% in certain years. Somebody born between 1960 and 1969 on a temporary contract can expect a earnings instability which is twice as large as the one for a permanent contract in the years 1987 through 1991 (not shown) and a little less in year 1994. Somebody who is on temporary contracts for his entire working life can expect a earnings instability 5 to 6 times higher than somebody on a permanent contract. This last value changes little across cohorts.

Table 6: Predicted Transitory Variance by Contract Type.

	Cohort born 1940-1949	Cohort born 1950-1959	Cohort born 1960-1969
Year 1987			
permanent contract	0.0645	0.0641	0.0658
temporary contract	0.0650	0.0693	0.1182
temporary contract always	0.3543	0.3539	0.3556
Year 1994			
permanent contract	0.0464	0.0464	0.0464
temporary contract	0.0515	0.0509	0.0569
temporary contract always	0.2616	0.2616	0.2632

5 Conclusions

In this paper we have used Italian panel data to estimate the impact of on-the-job tenure on measures of earnings instability. We found that while it increases the dispersion of long-term earnings profiles, tenure is associated with low levels of earnings instability, as would be the case if overall earnings profiles tended to their long term component as individuals settle down in their job. We estimate that each year of tenure is associated with a 13% reduction in instability. When looking at earnings instability distinguishing between workers on fixed term and permanent contracts, we found that the former can experience between three and six time more instability than the latter, depending upon the portion of the career spent on fixed term contracts. We interpret this evidence as a symptom of the differential accumulation of firm seniority across contract types.

The exercise of this paper is particularly relevant for Italy, which, starting from the late 1990s, experienced an increasing diffusion of short term contracts and labour market flexibility. Many authors have stressed that the welfare effects of these reforms depend on their impact on employment probability. Here we have provided evidence that, even conditional on being employed, there may be additional channels through which these new type of jobs affect individual welfare, namely through an increased uncertainty surrounding long term earnings profiles, and that these effects where at play in the years immediately preceding the reforms. The extension of our analy-

sis to more recent data is on the agenda for future research, once these data will become available.

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Table 7: Benchmark Model.

	Coefficient	Standard error
σ^2_{μ}	0.1285	0.0229
σ^2_{ϵ}	0.1124	0.0705
σ^2_{1940}	0.0926	0.0189
σ^2_{1950}	0.0787	0.0209
σ^2_{1960}	0.0764	0.0128
ρ	0.4014	0.0575
π_1	1.0684	0.0627
π_2	1.1647	0.0962
π_3	1.2462	0.1087
π_4	1.3390	0.1104
π_5	1.2805	0.1125
π_6	1.3275	0.1137
π_7	1.3297	0.1098
π_8	1.3488	0.1111
π_9	1.3256	0.1145
π_{10}	1.3505	0.1143
τ_1	0.7418	0.2389
τ_2	0.6675	0.2184
τ_3	0.4943	0.1546
τ_4	0.4501	0.1386
τ_5	0.5929	0.1819
τ_6	0.5658	0.1749
τ_7	0.5565	0.1733
τ_8	0.5367	0.1686
τ_9	0.6177	0.1954
τ_{10}	0.6176	0.2020
λ_{1950}	0.7336	0.0607
λ_{1960}	0.2950	0.0240
SSR	0.0097	
χ^2	495.4514	

Table 8: Random Walk in Age and in Tenure.

	Random Walk in Age		Random Walk in Tenure	
	Coefficient	Standard Error	Coefficient	Standard Error
σ_v^2	0.0500	0.0093	0.1502	0.0163
σ_ϕ^2	0.0055	0.0012	0.0084	0.0043
σ_ϵ^2	0.0579	0.0101	0.0582	0.0080
σ_{1940}^2	0.0590	0.0196	0.0689	0.0182
σ_{1950}^2	0.0609	0.0192	0.0592	0.0179
σ_{1960}^2	0.0767	0.0122	0.0670	0.0125
ρ	0.1715	0.0887	0.2413	0.0581
λ_{1950}	1.0647	0.0852	0.7462	0.0621
λ_{1960}	0.8060	0.1147	0.3173	0.0289
π_1	1.1043	0.0660	1.1256	0.0561
π_2	1.0932	0.0723	1.1292	0.0593
π_3	1.0875	0.0753	1.1309	0.0704
τ_1	0.7274	0.0846	0.7301	0.0835
τ_2	0.7257	0.0701	0.7790	0.0687
τ_3	0.6104	0.0750	0.7473	0.0847
SSR	0.0107		0.0156	
χ^2	352.0154		459.7714	