Earnings Volatility: Within-Year Variation of Wages and Non-Employment Spells

Melanie Borah (OvGU), Kabir Dasgupta (NZWRI at AUT),
Gail Pacheco (NZWRI at AUT), Alexander Plum (NZWRI at AUT)

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AUT UNIVERSITY NEW ZEALAND

SNZ Disclaimer

- Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975.
- The results presented in this study are the work of the authors, not of Statistics NZ.

Motivation

Background:

- Widespread indicator used to measure wage mobility
- Simple concept: approximate the society wide distribution of wage changes → standard deviation of the distribution of changes in log(earnings)
- Prevailing identification strategy:
  - Comparing changes in annual earnings
  - Comparing changes in a particular time point (month)

Motivation

Aim of this study:

Assessing the plausibility of not accounting for wage changes and non-employment spells within a year and determining the impact of this assumption on estimates of earnings volatility:

- Constructing a conceptual framework
- Defining three marker on earnings volatility, two referring to the prevailing identification strategy and a third accounting for within-year variation of wages and non-employment spells
- Empirical examination: Using three survey dataset (BHPS for UK, SOEP for Germany, HILDA for Australia) and a population-wide administrative dataset from Inland Revenue (NZ)

Motivation

Findings:

1) A decline of earnings volatility can only be partially observed in survey data
2) A substantial decrease can be found when using administrative data
3) Findings are robust for various sample specifications
4) Age and percentile related patterns pronounced in administrative data

Literature Review

- Nichols & Rehm 2014, p. S99: ‘inequality at a point in time is of little intrinsic interest if incomes are changing rapidly or frequently’
- Numerous studies base their analyses on annual earnings data from the US Panel Study of Income Dynamics (PSID) (see e.g. Haider 2001, Moffitt & Gottschalk 2002, Moffitt & Zhang 2018)
- Harmonized survey data on partly divergent income measures has been employed in cross-country comparisons (see e.g. Gangl 2005, Rodríguez et al. 2008, Bartels & Boenke 2013, Nichols & Rehm 2014)
- Minimizing the prevalence of measurement error, several studies make use of administrative income records as do Baker & Solon (2003) for Canada, Gustavsson (2008) for Sweden and Schröder et al. (2014) for Germany

Literature Review

- Cappellari & Jenkins (2014), using BHPS data, and Bartels & Boenke (2013), using SOEP data, offer a direct comparison of volatility measures depending on annual and monthly earnings information:
  - Cappellari & Jenkins (2014): results suggest that volatility measures based on annual gross earnings exceed those based on monthly figures
  - Bartels & Boenke (2013) find the same pattern
- None of the two studies provides a closer account of the reasons behind this difference

Conceptual framework

- Standard random effects model:

$$\log Y_{it_m} = \mu_t + \alpha_i + \nu_{it_m}$$

$$Y_{it_m} = e^{(\mu_t + \alpha_i + \nu_{it_m})}$$

- Individual i's annual earnings Y_{it} is given by:

$$Y_{it} = \sum_{m=1}^{M_{it}} e^{(\mu_t + \alpha_i + \nu_{it_m})}$$

- Individual i's average earnings in each period m can be represented by:

$$\bar{Y}_{it_m} = \frac{1}{M_{it}} \sum_{m=1}^{M_{it}} e^{(\mu_t + \alpha_i + \nu_{it_m})}$$

Conceptual framework

3 Marker:

- *Marker S^t comparing the wages of a single specific month of consecutive years:*

$$S^t = \sqrt{\mathrm{Var}[\mu_t - \mu_{t-1}] + \mathrm{Var}[\nu_{it_m} - \nu_{it-1_m}]}$$

- *Marker S_t^a comparing the annual sum of earnings of consecutive years:*

$$S_t^a = \sqrt{\mathrm{Var}[(\mu_t + \log(\mathrm{M_{it}})) - (\mu_{t-1} + \log(\mathrm{M_{it-1}}))]}$$

- *Marker S_t^m comparing periodic (monthly) mean earnings of consecutive years:*

$$S_t^m = \sqrt{\mathrm{Var}[\mu_t - \mu_{t-1}]}$$

Conceptual framework

Following relationships between Marker:

I. If there is no monthly variation of wages ($\sigma_v^2 = 0$), then $S^t = S_t^m = 0$. In the case that $\sigma_v^2 > 0$ than $S^t > S_t^m$ as $\mathrm{Var}\left[\nu_{it_m} - \nu_{it-1_m}\right] > 0$.

II. If $M_{it} = M_{it-1} = M_i \; \forall \; i$ then $S_t^m = S_t^a$, otherwise $S_t^a > S_t^m$.

III. If $M_{it} = M_{it-1} = M_i \; \forall \; i$ and $\sigma_v^2 > 0$ then $S_t^m = S_t^a$ and $S^t > S_t^m$.

Conceptual framework

Empirical identification:

$$\hat{S}_t = \left\{ \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it} + \hat{\varepsilon}_{it_m}}{\hat{\mu}_{it-1} + \hat{\varepsilon}_{it-1_m}} \right) - \hat{\rho}_t \right)^2}{N} \right\}^{0.5} \quad \text{with } \hat{\rho}_t = \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it} + \hat{\varepsilon}_{it_m}}{\hat{\mu}_{it-1} + \hat{\varepsilon}_{it-1_m}} \right) \right)}{N}$$

$$\hat{S}_t^a = \left\{ \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it}}{\hat{\mu}_{it-1}} \right) + \log\left(\frac{\widehat{M}_{it}}{\widehat{M}_{it-1}} \right) - \hat{\rho}_t^a \right)^2}{N} \right\}^{0.5} \quad \text{with } \hat{\rho}_t^a = \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it}}{\hat{\mu}_{it-1}} \right) + \log\left(\frac{\widehat{M}_{it}}{\widehat{M}_{it-1}} \right) \right)}{N}$$

$$\hat{S}_t^m = \left\{ \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it}}{\hat{\mu}_{it-1}} \right) - \hat{\rho}_t^m \right)^2}{N} \right\}^{0.5} \quad \text{with } \hat{\rho}_t^m = \frac{\sum_i \left(\log\left(\frac{\hat{\mu}_{it}}{\hat{\mu}_{it-1}} \right) \right)}{N}$$

Data

- Men (25-55), employed in both years (robustness: continuously employed)
- Consumer Price Index
- Information on last *a)* month's gross labour income, *b)* annual gross labour income and *c)* annual weeks/months employed required
- BHPS (1991-2008):
- SOEP (1984-2016):
- HILDA (2002-2015)
- IDI (2000-2015)

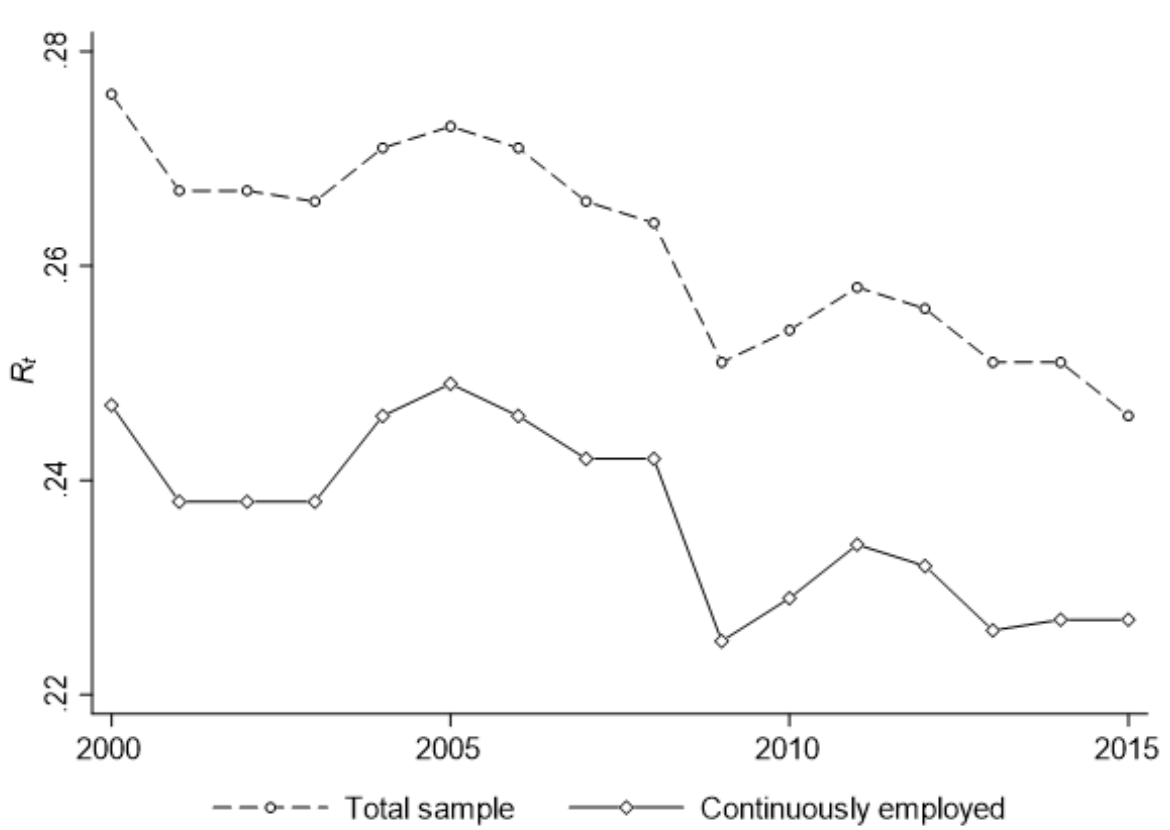
Empirical findings

Monthly variation of wages:

$$R_t = \frac{\sum_i \left(\frac{\left(\sum_m \left(\hat{w}_{it_m} - \hat{\mu}_{it} \right)^2 \right)^{.5}}{\hat{\mu}_{it}} \right)}{N}$$

Empirical findings

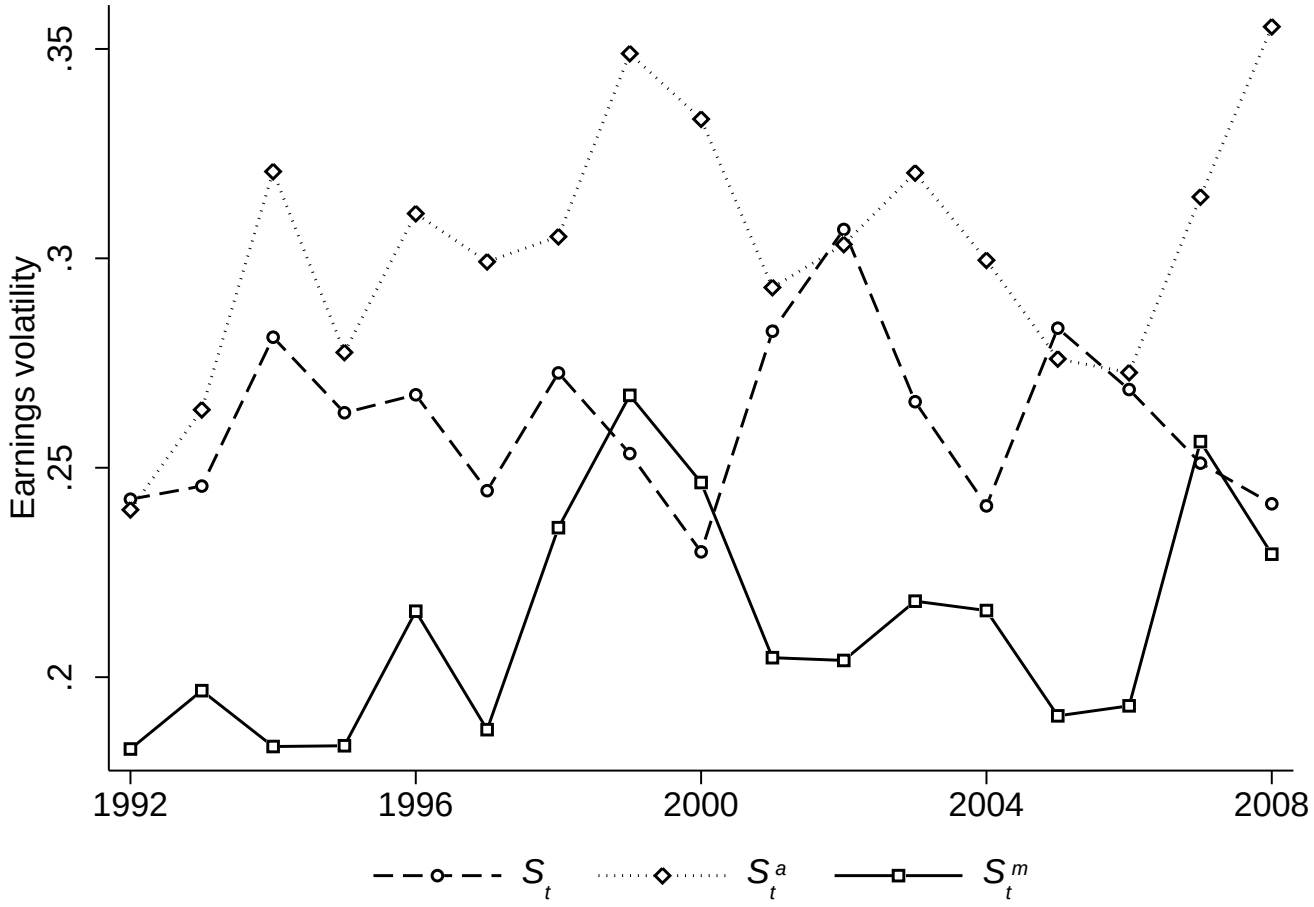
Figure 1: Within-year variation of wages



Notes: IDI (2018), own calculations

Empirical findings

Figure 2: Earnings volatility (BHPS)

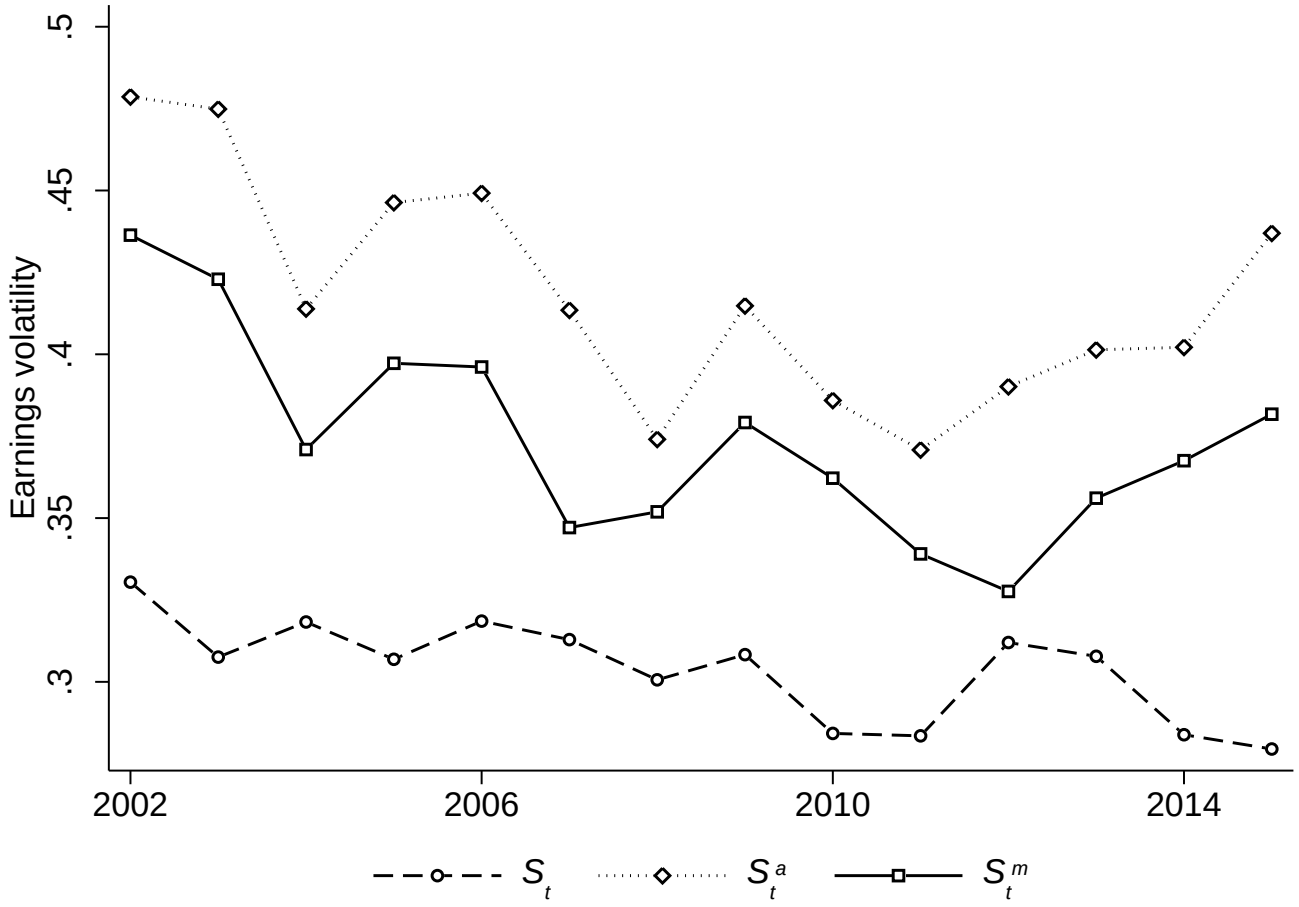


Empirical findings

Figure 2: Earnings volatility (SOEP)

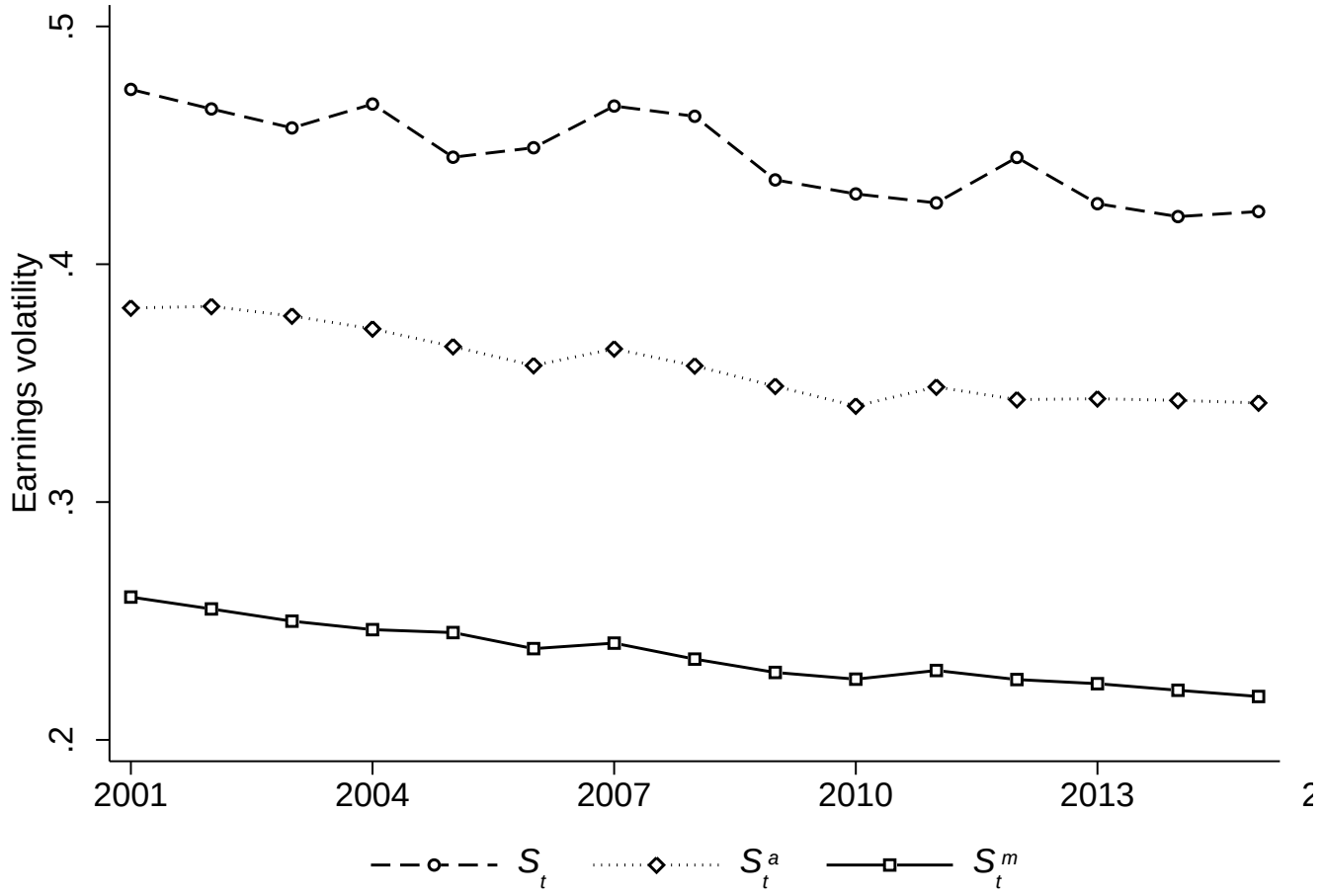
Empirical findings

Figure 2: Earnings volatility (HILDA)



Empirical findings

Figure 2: Earnings volatility (IDI)



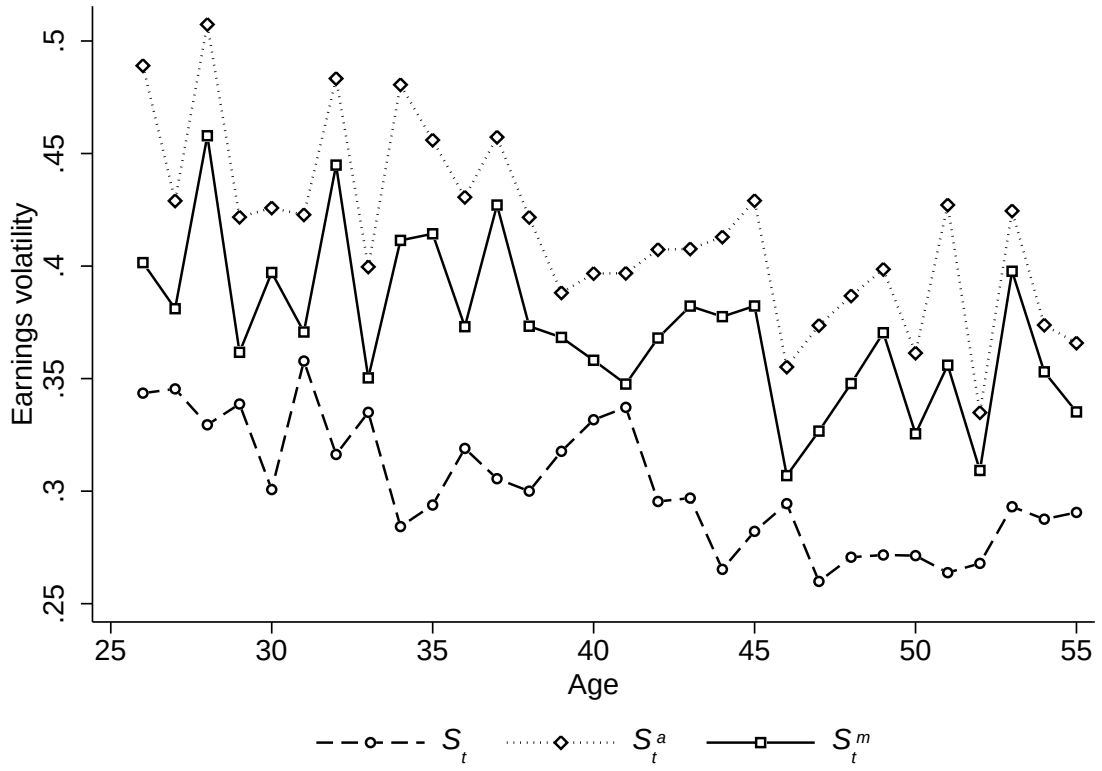
Empirical findings

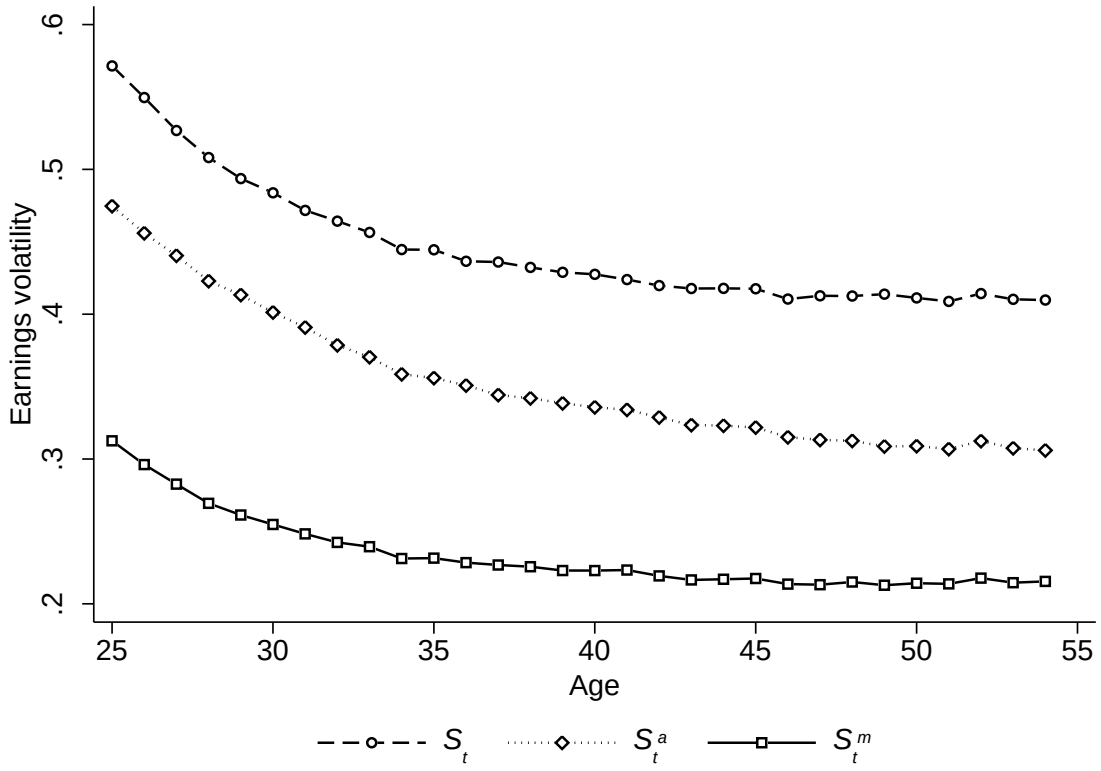
Table 1: Earnings volatility for different marker

	Total sample				*Continuously employed*			
	BHPS	SOEP	HILDA	IDI	BHPS	SOEP	HILDA	IDI
$\hat{S}_t$	0.261	0.192	0.304	0.446	0.235	0.168	0.280	0.312
	(0.020)	(0.024)	(0.016)	(0.019)	(0.022)	(0.016)	(0.016)	(0.016)
$\hat{S}_t^a$	0.302	0.279	0.418	0.358				
	(0.030)	(0.018)	(0.035)	(0.015)	0.193	0.182	0.326	0.152
$\hat{S}_t^m$	0.212	0.212	0.374	0.236	(0.023)	(0.017)	(0.032)	(0.008)
	(0.027)	(0.017)	(0.031)	(0.013)				
$\hat{S}_t / \hat{S}_t^m$	1.231	0.906	0.813	1.890	1.218	0.923	0.859	2.053
$\hat{S}_t^a / \hat{S}_t^m$	1.425	1.316	1.118	1.517				
T	17	32	14	15	17	32	14	15

Empirical findings

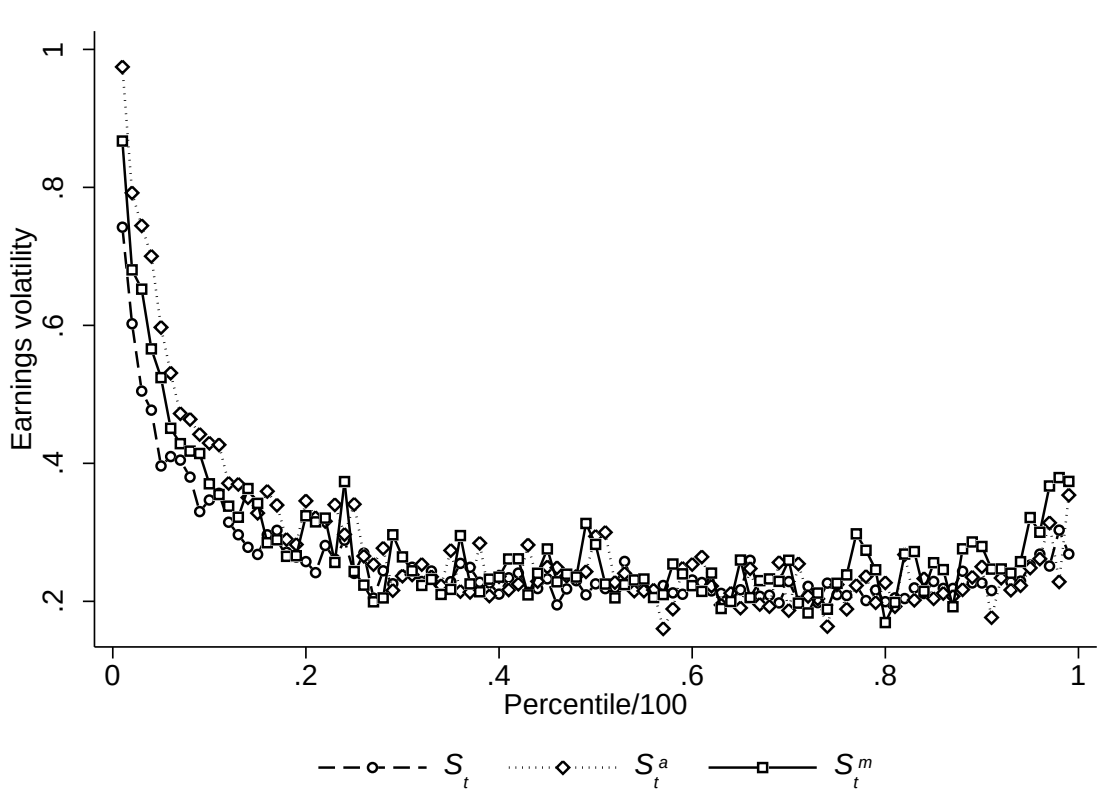
Figure 3: Earnings volatility (HILDA & IDI), differentiated according to age

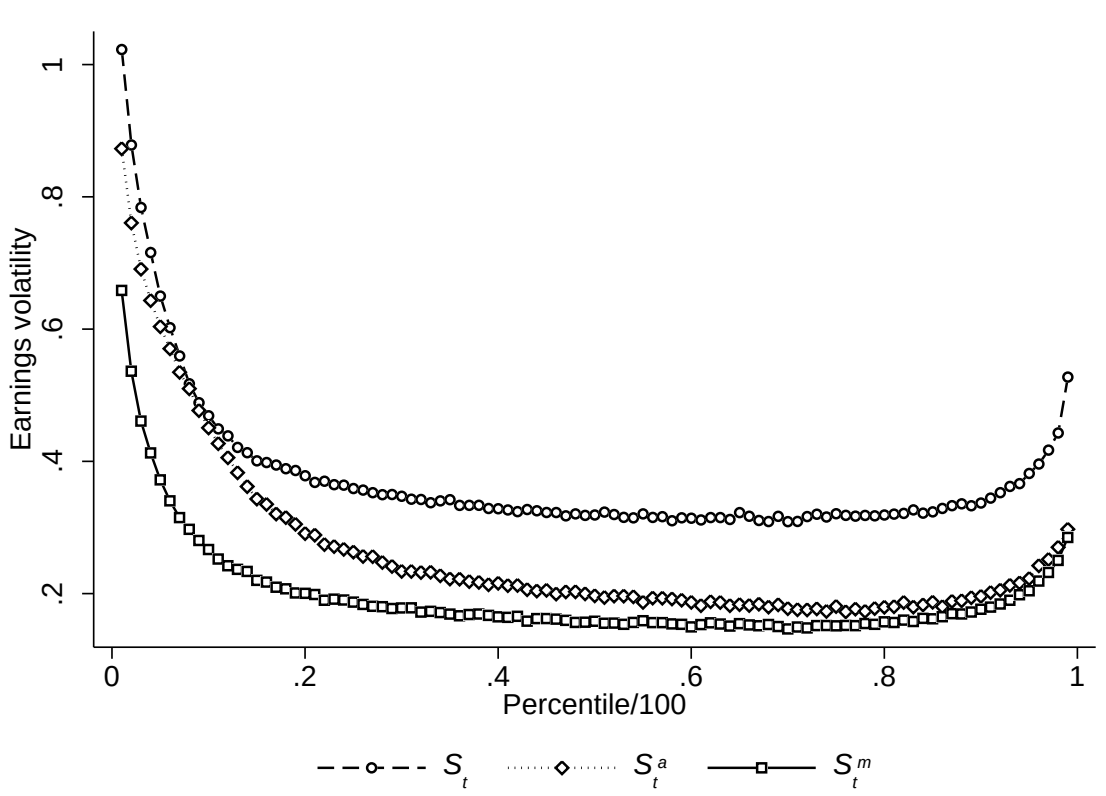




Empirical findings

Figure 4: Earnings volatility (HILDA & IDI), differentiated according to percentile





Conclusion

Findings:

1) A decline of earnings volatility can only be partially observed in survey data
2) A substantial decrease can be found when using administrative data
3) Findings robust for various sample specifications
4) Age and percentile related patterns pronounced in administrative data

Thank you very much for your time

Questions?