

# What Did You Really Earn Last Year?

## Drivers of Measurement Error in Survey Income Data

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Statistik Austria NutzerInnen-Konferenz 2017, Wien

# Agenda

- 1 Background and Research Question
- 2 A first look at the data
- 3 Methods
- 4 Results
- 5 Summary

# Background

## Typical Problems of Household Surveys

- Non-Random unit non-response  
→ Pareto Interpolation
- (Non-random) item non-response  
→ (Multiple) Imputations
- **Misreporting**  
→ assumption that measurement errors is iid and serially uncorrelated

# Research Question

**Which factors drive Income Measurement Error?**

**Measurement Error = Survey Report - Administrative Record Value**

# Data

## Austrian EU-SILC 2008-2011

- Rotational panel
- Population: private households
- Sample size: 44.024 individuals
- **Income according to survey report and administrative register for the same observations**
- Administrative registers: social security database, payroll tax register, Austrian federal pension fund, family allowance register, Austrian transfers data
- 98 % of survey respondents were matched to registers, based on bPIN

# Data - Income Concept

	PY010	<b>Employee cash (near cash) income</b>	→	Payroll Tax Stat.
+	PY050	Income from self-employment		
+	PY090	<b>Unemployment benefits</b>	→	Transfer Data
+	PY100	<b>Old-age benefits</b>	→	Federal Pension Fund
+	PY110	Survivor' benefits	→	Social Insurance Tax
+	PY120	Sickness benefits	→	Social Insurance Tax
+	PY130	Disability benefits	→	Social Insurance Tax
+	PY140	Education-related allowances	→	Family Allowance Register
+	PY080	Pension from private plans		
<hr/>				
=		Sum of Personal Income		
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## Data - Reporting of Income Types

	Wages (%)			Pensions (%)			Unemp. ben. (%)		
	Svy.	Adm.	Diff.	Svy.	Adm.	Diff.	Svy.	Adm.	Diff.
2008	53.8	56.6	-2.8	24.9	24.1	0.8	7.1	10.2	-3.1
2009	54.8	58.0	-3.2	25.0	24.7	0.4	7.4	10.2	-2.8
2010	55.4	57.9	-2.4	25.9	25.3	0.6	9.1	12.6	-3.5
2011	55.8	59.0	-3.2	24.0	24.6	-0.6	9.2	12.7	-3.5

Table: Reporting of Income Types - EU SILC 2008-2011

# Data - Mismatch Structure

$$Pr(Y_{i,k} = j) = \begin{cases} Pr(Y_{i,k} = 0x0) & \text{if no income in survey and admin} \\ Pr(Y_{i,k} = 0xA) & \text{if only admin income report} \\ Pr(Y_{i,k} = S<A) & \text{if survey under-reporter} \\ Pr(Y_{i,k} = S=A) & \text{if survey corresponds to admin} \\ Pr(Y_{i,k} = S>A) & \text{if survey over-reporter} \\ Pr(Y_{i,k} = Sx0) & \text{if only survey income report} \end{cases}$$



## Data - Mismatch Structure

	Obs. (%)	Abs. ( $\mu$ )	Rel. ( $\mu$ )	Obs. (%)	Abs. ( $\mu$ )	Rel. ( $\mu$ )
	<b>Total HH Disp. Income</b>			<b>Wages</b>		
0x0	13.6	0.0	0.0	38.5	0.0	0.0
0xA	5.0	-4757.4	-1.2	5.7	-3102.6	-1.0
S < A	25.6	-5775.6	-0.2	22.7	-5681.4	-0.2
S = A	34.0	-66.4	0.0	13.3	-156.6	0.0
S > A	19.1	5778.7	1.5	17.2	5821.9	1.6
Sx0	2.7	11795.2	Inf	2.5	10473.7	Inf
	<b>Pensions</b>			<b>Unemployment B.</b>		
0x0	74.2	0.0	0.0	86.6	0.0	0.0
0xA	1.9	-8527.1	-1.0	4.2	-2641.6	-1.0
S < A	1.1	-6105.1	-0.3	3.8	-1952.6	-0.4
S = A	20.6	-12.6	0.0	1.1	-6.5	0.0
S > 0	1.0	6784.8	3.5	3.6	1875.2	1.3
Sx0	1.2	11914.4	Inf	0.6	6632.7	Inf

Table: Structure of Mismatch in Income Reporting - 2011

# Explanations for Misreporting of Income

## 1 Social Desirability

- questions on income are sensitive
- deliberate mis-reporting of income out of a desire for social comfort (Moore et al. 2000, Bound et al. 2001)
- mean-reverting error (Kreiner et al. 2015, Kim and Tamborini 2014, Pischke 1995, Bound and Krueger, 1991)

## 2 Socio-demographic characteristics

- males have a higher propensity to over-report (Bollinger 1998, Pedace and Bates 2000, Tamborini and Kim, 2013)
- the better educated, the lower the propensity to misreport (Bound et al. 1994)
- age, unclear a priori
- stability of employment status, variation in income during the income reference period → telescoping errors
- health, degree of urbanisation, language

## 3 Survey Design and Setting

- CAPI vs. CATI, proxy responses, month of interview

## 4 Learning effect

# Descriptive Results - Social Desirability

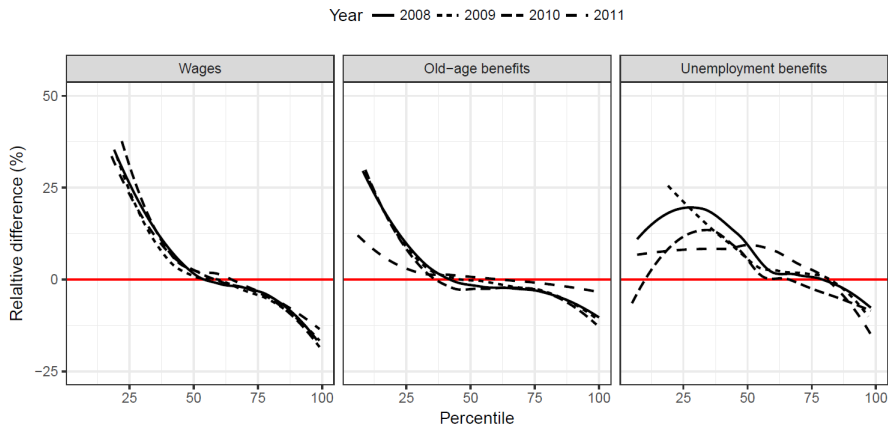


Figure: Mean Reversion

# Descriptive Results - Learning Effect

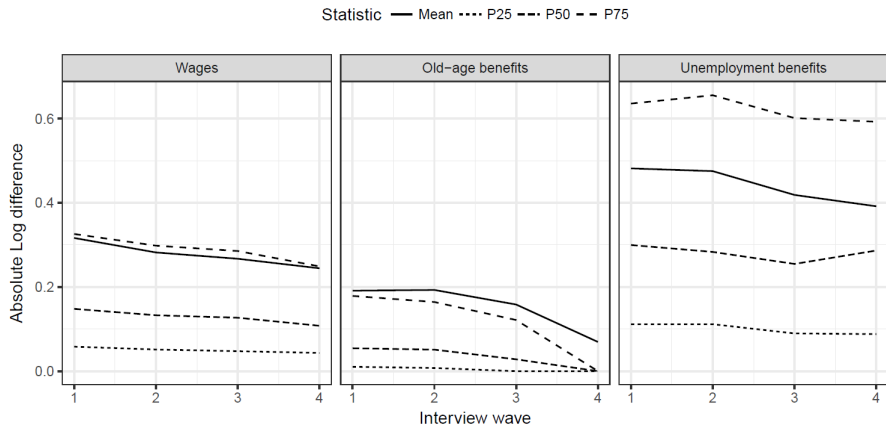


Figure: Learning Effect

# Method - Drivers of Mismatch

## Multinomial Logit Model

- **Direction of misreporting**
- Dependent variable:  $Pr(Y_{i,k} = j)$ ; restricted to under-reporters ( $S < A$ ), over-reporters ( $S > A$ ) and same group ( $S = A$ )
- Explanatory variables: reasons for measurement error
- Allow the estimated coefficients to vary across mismatch groups → identify different mismatch determinants for different groups
- Avoid that negative and positive errors cancel out each other

# Method - Drivers of Mismatch II

## Fixed Effects Regression

- **Extent of misreporting**
- Correct for omission of relevant, but unobservable determinants of measurement error
- Unobserved heterogeneity of respondents (cognitive ability,...)
- **Social Desirability Bias**
  - Dependent variable: difference between survey and register value
- **Learning Effect**
  - Dependent variable: absolute value of measurement error
- Exclude variables with low-within variation

# Multinomial Logit

	Wages		Pensions		Unemp. Benefits	
	$S < A$	$S > A$	$S < A$	$S > A$	$S < A$	$S > A$
<b>A. Social desirability</b>						
Relative income (Ref: 5. Decile)						
1. Decile	-0.55	2.31	-0.57	1.50	-0.16	1.33
2. Decile	-0.08	1.72	-0.10	0.83	-0.02	0.82
3. Decile	-0.05	1.11	-0.35	0.33	0.78	1.04
4. Decile	0.11	0.62	0.12	0.25	0.55	0.91
6. Decile	0.13	-0.33	0.39	-0.00	0.30	-0.24
7. Decile	0.40	-0.43	0.45	0.23	0.32	-0.13
8. Decile	0.47	-0.60	0.42	0.10	0.67	-0.47
9. Decile	0.87	-0.72	0.61	-0.10	0.44	-1.10
10. Decile	1.53	-0.80	1.35	0.27	1.15	-1.35
<b>B. Learning effect</b>						
Wave of interview (Ref: 1 <sup>st</sup> )						
2 <sup>nd</sup>	-0.11	-0.11	0.16	0.10	0.29	0.10
3 <sup>rd</sup>	-0.04	-0.15	0.19	0.19	0.30	0.36
4 <sup>th</sup>	-0.13	-0.15	0.18	0.12	-0.38	-0.22
Intercept	1.37	-0.94	8.25	16.12	1.76	1.69
Num. obs.	17108		7957		1987	

	Wages		Pensions		Unemp. Benefits	
	$S < A$	$S > A$	$S < A$	$S > A$	$S < A$	$S > A$
<b>C. Sociodemographic characteristics</b>						
Gender (Ref: Female)						
Male	-0.18	<b>0.71</b>	<b>-0.29</b>	0.15	<b>-0.28</b>	<b>0.27</b>
Education						
Primary	0.06	<b>0.40</b>	0.17	0.01	<b>0.30</b>	<b>0.52</b>
Upper secondary	-0.14	<b>0.78</b>	-0.04	0.12	0.14	<b>0.27</b>
Post-secondary	<b>0.03</b>	<b>1.15</b>	<b>-0.52</b>	<b>0.06</b>	<b>-0.19</b>	<b>0.85</b>
Bachelor or Master	<b>-0.29</b>	<b>0.87</b>	<b>0.28</b>	<b>0.51</b>	<b>0.77</b>	<b>0.97</b>
Short-cycle tertiary	-0.05	<b>0.89</b>	-0.16	0.10	<b>-0.27</b>	0.12
Doctoral	-0.00	<b>0.93</b>	<b>0.20</b>	<b>0.25</b>	<b>-0.68</b>	<b>0.50</b>
Age						
Age	<b>-0.05</b>	-0.01	<b>-0.26</b>	<b>-0.53</b>	<b>-0.08</b>	0.00
Age <sup>2</sup>	<b>0.00</b>	0.00	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	-0.00
Country of birth (Ref: AUT)						
EU15	<b>-0.13</b>	<b>0.19</b>	<b>0.22</b>	<b>0.93</b>	<b>-0.24</b>	0.011
EU10	<b>0.04</b>	-0.01	<b>0.05</b>	<b>0.22</b>	<b>1.09</b>	<b>0.90</b>
Yugosphere	<b>0.28</b>	0.09	<b>0.36</b>	<b>0.24</b>	<b>0.25</b>	<b>0.24</b>
Turkey	<b>0.17</b>	-0.11	<b>0.55</b>	<b>0.19</b>	-0.01	<b>0.33</b>
Other	<b>0.51</b>	0.11	0.16	<b>0.38</b>	<b>0.56</b>	<b>0.59</b>
<hr/>						
Num. obs.	17108		7957		1987	



	Wages		Pensions		Unemp. Benefits	
	S < A	S > A	S < A	S > A	S < A	S > A
<b>C. Sociodemographic characteristics</b>						
Health status (Ref: Fair)						
Very bad	<b>0.30</b>	<b>0.15</b>	<b>0.31</b>	<b>0.43</b>	<b>-0.07</b>	<b>0.16</b>
Bad	-0.14	-0.05	0.05	0.20	<b>0.51</b>	<b>0.20</b>
Good	-0.08	0.07	-0.10	-0.04	<b>0.31</b>	0.01)
Very good	<b>-0.24</b>	<b>0.24</b>	<b>-0.35</b>	0.09	0.15	-0.13
Degree of urbanisation (Ref: < 10000)						
>10 000 inhabitants	-0.09	-0.08	-0.19	-0.09	<b>-0.25</b>	-0.05
>100 000 inhabitants	-0.13	0.07	-0.20	0.08	<b>-0.50</b>	-0.06
Changes in employment (Ref: None)						
Once	0.13	-0.02	<b>1.32</b>	<b>0.32</b>	<b>0.22</b>	<b>0.16</b>
Twice	0.00	<b>-0.35</b>	<b>1.47</b>	<b>1.62</b>	<b>0.41</b>	<b>0.21</b>
Thrice or more	0.17	<b>0.24</b>	<b>0.26</b>	0.04	<b>0.65</b>	<b>0.38</b>
Months in corresponding employment status (Ref: 12 months)						
<6 months	<b>1.07</b>	<b>-0.68</b>	<b>0.36</b>	<b>0.20</b>	<b>1.10</b>	<b>-1.11</b>
6-8 months	<b>0.74</b>	0.08	<b>-0.28</b>	0.15	<b>0.57</b>	<b>-0.26</b>
9-11 months	<b>0.44</b>	<b>0.51</b>	0.07	0.06	<b>0.33</b>	-0.15
AIC	33126.50		16294.53		3633.02	
Num. obs.	17108		7957		1987	

	Wages		Pensions		Unemp. Benefits	
	$S < A$	$S > A$	$S < A$	$S > A$	$S < A$	$S > A$
<b>D. Survey setting</b>						
Mode of interview (Ref: CAPI)						
CATI	-0.08	-0.03	-0.05	-0.03	<b>-0.13</b>	<b>-0.25</b>
Type of interview (Ref: Personal)						
Proxy	<b>0.35</b>	0.09	<b>0.37</b>	<b>0.30</b>	<b>0.18</b>	0.09
Month of interview (Ref: March to May)						
June to Aug.	0.16	0.14	0.10	0.12	-0.03	0.06
Sept. to Nov.	<b>0.29</b>	<b>0.36</b>	<b>0.56</b>	<b>0.36</b>	0.04	0.13
Year of interview (Ref: 2008)						
2009	0.02	-0.01	0.05	0.12	-0.09	0.07
2010	0.01	-0.07	0.15	0.09	<b>-0.21</b>	<b>-0.34</b>
2011	0.00	0.00	0.00	0.00	0.00	0.00
AIC	33126.50		16294.53		3633.02	
Num. obs.	17108					

## Panel - Social Desirability Bias

	Wages	Pensions	Unempl. Benefits
<b>A. Social desirability</b>			
Relative income (Ref: 5. Decile)			
1. Decile	<b>8490.73</b>	<b>3903.96</b>	<b>727.94</b>
2. Decile	<b>6816.02</b>	<b>2048.06</b>	<b>718.94</b>
3. Decile	<b>4465.05</b>	<b>1283.11</b>	<b>-43.48</b>
4. Decile	<b>1714.97</b>	135.57	541.17
6. Decile	<b>-1750.07</b>	-548.69	-410.11
7. Decile	<b>-4037.27</b>	-1260.63	-587.59
8. Decile	<b>-6875.40</b>	<b>-2135.00</b>	<b>-1512.75</b>
9. Decile	<b>-12529.51</b>	<b>-4001.61</b>	<b>-2367.40</b>
10. Decile	<b>-21026.18</b>	<b>-7802.47</b>	<b>-4281.73</b>
<b>Other controls</b>			
Learning effect	x	x	x
Sociodemographic characteristics	x	x	x
Survey setting	x	x	x
Num. obs.	22873	10733	2584

This table shows the results of panel regressions with positive and negative reporting errors as dependent variable. Gender, education and country of birth have been removed from the baseline specification

## Panel - Learning Effect

	Wages	Pensions	Unempl. Benefits
<b>D. Learning effect</b>			
Wave of interview (Ref: 1 <sup>st</sup> )			
2 <sup>nd</sup>	589.29	-1074.36	-57.90
3 <sup>rd</sup>	1083.83	-2007.99	150.44
4 <sup>th</sup>	2220.30	-2514.30	158.29
<b>Other controls</b>			
Social desirability	x	x	x
Sociodemographic characteristics	x	x	x
Survey setting	x	x	x
Num. obs.	22873	10733	2584

This table shows the results of panel regressions with absolute values of the reporting errors as dependent variable. Gender, education and country of birth have been removed from the baseline specification.

# Owen value decomposition

**Table:** Decomposition of explained variance – SILC 2008-2011

	Wages	Pensions	Unempl. Benefits
Proportion of variance explained	17.4	9.8	46.1
A. Social desirability	69.2	54.0	18.2
B. Sociodemographic characteristics	30.1	31.6	56.1
C. Survey setting	0.6	11.6	17.6
D. Learning effect	0.0	2.9	8.1

# Summary

- data-quality is a crucial matter and the extent and direction of misreporting are central aspects of overall data quality
- EU-SILC 2008-2011 offers as unique opportunity for the evaluation of measurement error
- strong evidence for social desirability bias in survey reported incomes
- complex income stream and employment pattern increases misreporting
- social benefits are reported more accurately in telephone than personal interviews
- mixed evidence for the presence of learning effects
- for some socio-demographic groups, in particular those most relevant for policy makers, survey income data may be an unfirm ground for decision-making

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