

International Workshop:

Education in Adulthood and the Labour Market

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**Income Effects of Vocational Further Training: Compensation or
Reinforcement of Qualification-Related Inequalities?**

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Overview

1. Introduction

- Further training and inequality research
- Problems in estimating *causal* training effects

2. Existing Research

3. Data and Methods

- The German Microcensus-Panel
- Fixed- and Random-Effects-Models

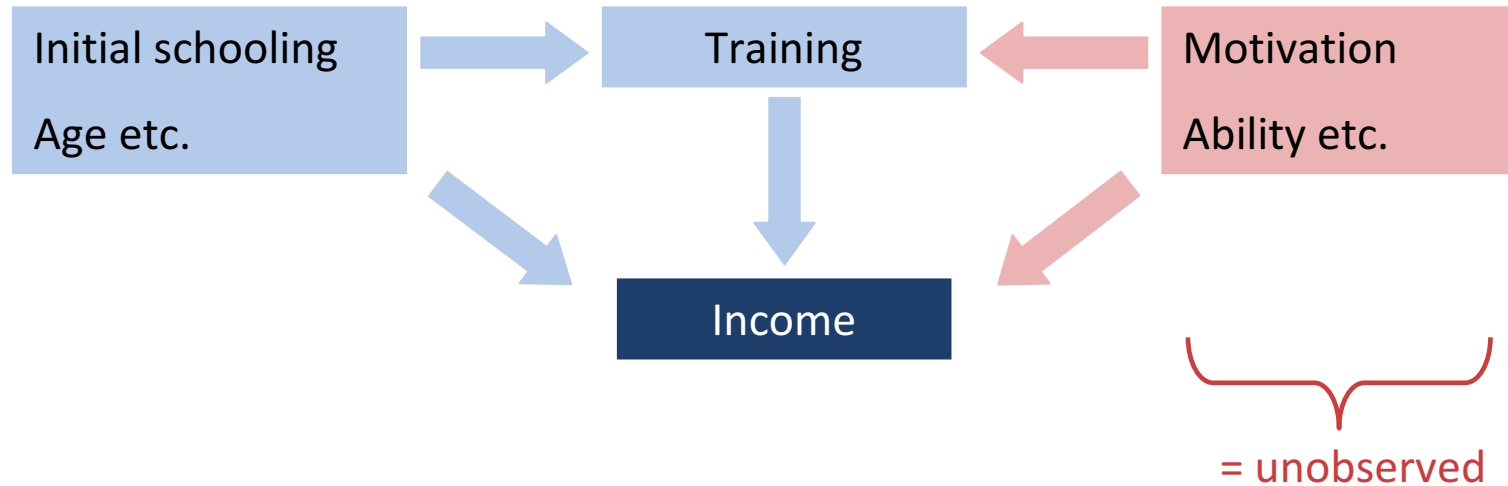
4. Empirical Findings

5. Discussion

Further training and inequality research

- **Thesis: „Lifelong Learning“ becomes more and more important**
 - required qualifications are less and less provided by initial schooling and training
 - continuous training necessary
- **Sociological inequality research:**
 - Initial schooling and training is the most important determinant of status allocation
 - The gap between lowly- and highly qualified is rising (Wolter 2009)
 - Further training: Compensation of human capital under-investments possible?
 - Highly selective access to further training (e.g. Schömann/Leschke 2004)
 - Reproduction- or „boosting“-thesis: Further training boosts social inequalities (Becker/Hecken 2005)
- **But:**
 - The „boosting thesis“ is only true in the case where training activities affect relevant status dimensions
 - Knowledge about the income effects of further vocational training necessary
 - ...and the interaction effect between initial training and further training on income

The Selection Problem



Selection into treatment group (training participants) is not at random.

Unobserved characteristics affect both training activity and income.

- ➔ Training participants possibly would have higher income even *without* further training.
- ➔ Overestimation of training effects in conventional models

- **One possible solution:**
 - Panel data using fixed- and random-effects-models
- **Proceeding:**
 - Empirical analyses using German Microcensus-Panel Data (comparison to GSOEP?)
 - Empirical examination of the impact of the selection effect by comparing different modeling techniques
 - Training returns in different levels of initial schooling and training

Existing Research

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- **Definition „further training“:**

- „Continuation or resumption of organized learning after having finished an initial phase of schooling [or training] of variable length“ „Fortsetzung oder Wiederaufnahme organisierten Lernens nach Abschluss einer unterschiedlich ausgedehnten ersten Ausbildungsphase“ (Deutscher Bildungsrat 1970).

- Vocational further training
- General further training
- „Informal“ learning

- **Dimensions of and measuring further training**

- Pure participation (yes/no)
- Duration/ amount of further training
- Location: on the job, off the job
- Financing: individual, internal, policy-funded
- and many more...

Existing Research

- **Income effects of vocational further training: mixed evidence**

Source	Data	Method of Selection Control	Effect
Büchel/Pannenberg 2004	GSOEP	Fixed Effects/Fixed Growth	+
Pischke 2001	GSOEP	Fixed Effects/Fixed Growth	n.s.
Lechner 1999	GSOEP	Matching	+
Pannenberg 1998	GSOEP	Fixed Effects	+
Jürges/Schneider 2006	GSOEP	Fixed Growth/Matching	n.s.

- **Results vary by analysed period, population and – above all – by method of selection control (cf. Fitzenberger/Prey 1998)**
- **Findings show little or no income effects**

Data and Methods

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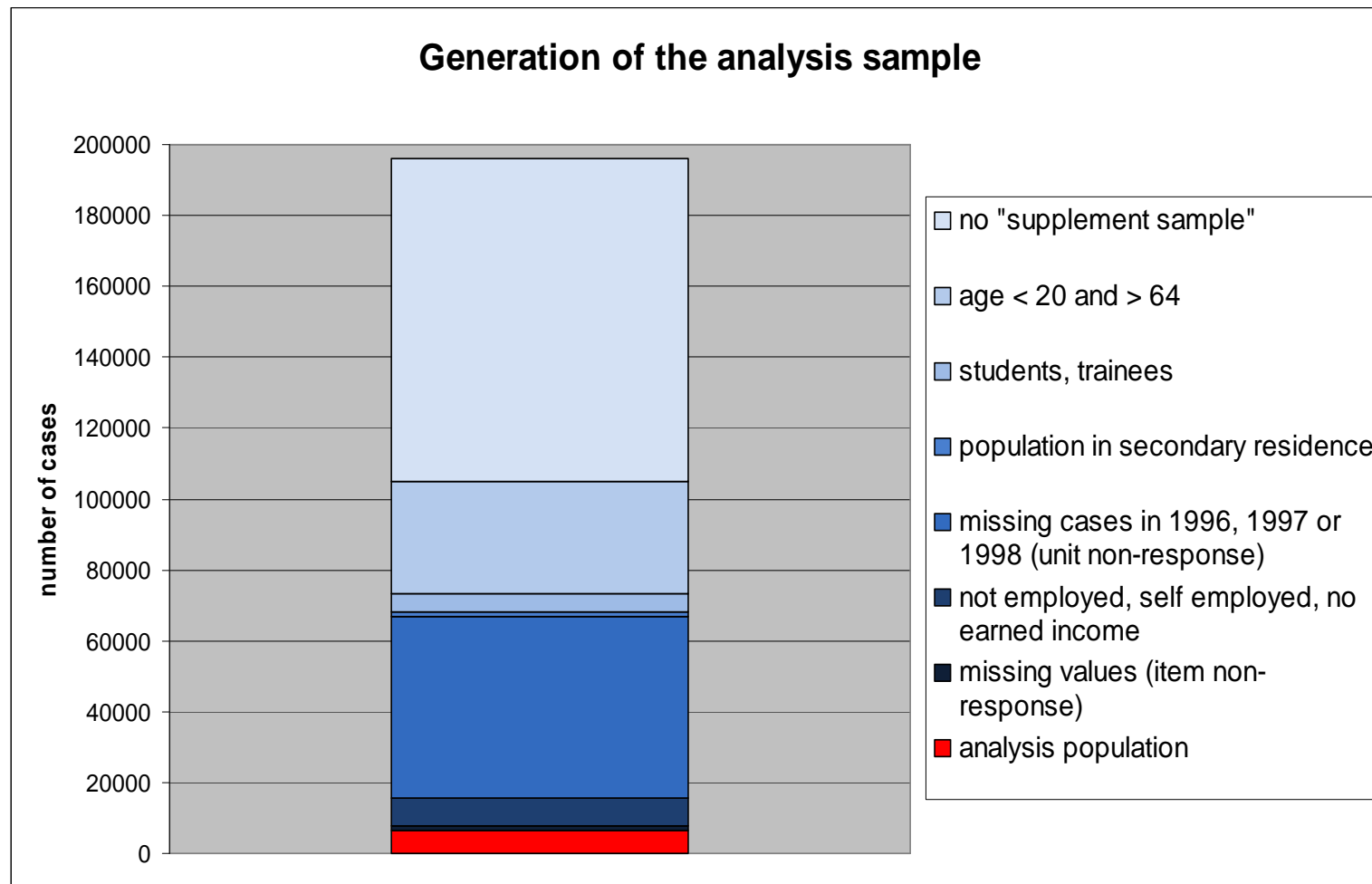
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Data: Microcensus and Microcensus-Panel

- **The German Microcensus:**
 - Annual population survey of the German official statistics office
 - Sample = area sample:
 - 1% of the German resident population
 - rotation sample: only $\frac{1}{4}$ of the sample is renewed each year; people are interviewed in four yearly waves
 - Participation obligatory
 - Concept of „reference week“ / „reference month“ (mostly last week of April)
- **Microcensus-Panel 1996–1999:**
 - Employs rotating panel study
 - Matching of four cross-sectional samples
 - Critical problem: mobility bias
 - Weighting variables are provided in the data file...
 - ...but are not used in our analysis:
 - software limitations
 - there are doubts regarding the use of weighting variables in multivariate analysis
 - Fixed-effects-models control for possible bias with respect to income level and participation in further training

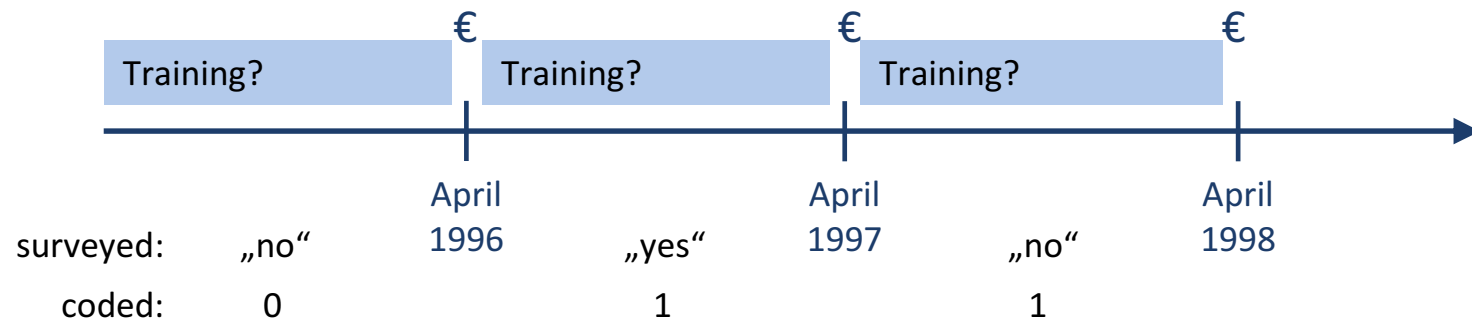
- **Scientific Use File (70% of the original sample)**
- **Analysis population:**
 - employees
 - aged 20 to 64 years
 - no students
 - Means of subsistence from earned income
 - Balanced panel 1996–1998
- **Questions on further training are only asked in the „supplement sample“ of the Microcensus**
 - Sampling ratio = 45%
 - More than one half of the cases cannot be used
 - Supplement sample is not integrated in wave 1999 (anonymization)
- **Resulting number of cases: 6.340 persons = 19.020 observations**



Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Variables

- **Income**
 - Logarithm of total, inflation-adjusted net income (€) in the reference month
- **Further training**
 - Participation in vocational further training in the current census period or at least one of the preceding periods (yes/no)
 - Duration/amount of activities in months



- **Control variables**

Fixed- and Random-Effects-Models

Introduction

Existing Research

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- **Goal: control for unobserved time-constant variables**
- **„Error Components-Model“:**

$$y_{it} = \alpha + \beta_1 X_{it} + \beta_2 Z_i + \mu_i + \varepsilon_{it} \quad (1)$$

- μ_i = person-specific, time-constant error
- ε_{it} = „common“, idiosyncratic error
- μ_i contains unobserved time-constant heterogeneity concerning y_{it}

Fixed- and Random-Effects-Models

- **Goal: control for unobserved time-constant variables**
- **„Error Components-Model“:**

$$y_{it} = \alpha + \beta_1 X_{it} + \beta_2 Z_i + \mu_i + \varepsilon_{it} \quad (1)$$

- μ_i = person-specific, time-constant error
 - ε_{it} = „common“, idiosyncratic error
 - μ_i contains unobserved time-constant heterogeneity concerning y_{it}
-
- **Two alternatives:**
 1. Estimate μ_i using a Random-Effects-Model
Assumption: differences μ_i are at random ($Cov(X_{it}, \mu_i) = 0$)
 2. Eliminate μ_i in the Fixed-Effects-Model
Assumption: differences μ_i are not at random and $Cov(X_{it}, \mu_i) \neq 0$

Fixed- and Random-Effects-Models

- **Fixed-effects-specification:**

- Means of each variable for each person i over T :

$$\bar{y}_{it} = \alpha + \beta_1 \bar{X}_{it} + \beta_2 Z_i + \mu_i + \bar{\varepsilon}_{it} \quad (2)$$

- Subtraction of equation (2) from equation (1) :

$$(y_{it} - \bar{y}_i) = (X_{it} - \bar{X}_i)\beta_1 + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (3)$$

Fixed- and Random-Effects-Models

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- Means of each variable for each person i over T :

$$\bar{y}_{it} = \alpha + \beta_1 \bar{X}_{it} + \beta_2 Z_i + \mu_i + \bar{\varepsilon}_{it} \quad (2)$$

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$$(y_{it} - \bar{y}_i) = (X_{it} - \bar{X}_i)\beta_1 + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (3)$$

- **Properties of the FE-estimator:**

- always consistent, but less efficient than the RE-model
- only cases with intraindividual variation in X and y contribute to the estimation
- effects of time-constant variables are not estimable (eliminated by FE-transformation)

Empirical Findings

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Income Effects of Vocational Further Training

	Introduction		Existing Research		Data & Methods		Empirical Findings		Discussion	
	OLS (total)									
	Model 1	Model 2								
Training (1=yes)	0,203***	0,080***								
Firm change		0,032*								
Occupational change		-0,033								
Hours of work		0,020***								
Tenure		0,011***								
Tenure ²		-0,000***								
1997		-0,022***								
1998		-0,025***								
Time-constant control variables		yes								
Constant	7,116***	5,539***								
F (χ^2 for RE-model)	365,15***	657,84***								
number of observations	19020	19020								

Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: $p < 0,1$; *: $p < 0,05$; **: $p < 0,01$; ***: $p < 0,001$ (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects of Vocational Further Training

	OLS (total)		Random Effects		
	Model 1	Model 2	Model 1	Model 2	
Training (1=yes)	0,203***	0,080***	0,090***	0,065***	
Firm change		0,032*	0,024*	0,018	
Occupational change		-0,033	-0,020	-0,020	
Hours of work		0,020***	0,013***	0,012***	
Tenure		0,011***	0,012***	0,008***	
Tenure ²		-0,000***	-0,000***	-0,000***	
1997		-0,022***	-0,007+	-0,020***	
1998		-0,025***	-0,002	-0,021***	
Time-constant control variables		yes		yes	
Constant	7,116***	5,539***	6,531***	5,788***	
F (χ^2 for RE-model)	365,15***	657,84***	1,9×10 ⁶ ***	4×10 ⁶ ***	
number of observations	19020	19020	6340	6340	

Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects of Vocational Further Training

	OLS (total)		Random Effects		Fixed Effects
	Model 1	Model 2	Model 1	Model 2	Model 1
Training (1=yes)	0,203***	0,080***	0,090***	0,065***	0,030**
Firm change		0,032*	0,024*	0,018	0,001
Occupational change		-0,033	-0,020	-0,020	-0,010
Hours of work		0,020***	0,013***	0,012***	0,005***
Tenure		0,011***	0,012***	0,008***	0,004**
Tenure ²		-0,000***	-0,000***	-0,000***	-0,000*
1997		-0,022***	-0,007+	-0,020***	0,001
1998		-0,025***	-0,002	-0,021***	0,012**
Time-constant control variables		yes		yes	
Constant	7,116***	5,539***	6,531***	5,788***	6,920***
F (χ^2 for RE-model)	365,15***	657,84***	1,9×10 ⁶ ***	4×10 ⁶ ***	14,29***
number of observations	19020	19020	6340	6340	6340

Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by region and age

Introduction Existing Research Data & Methods Empirical Findings Discussion

	Western Germany			Eastern Germany		
	Overall	Age 20–44	Age 45–64	Overall	Age 20–44	Age 45–64
Training (1=yes)	0,024*			0,058*		
Firm change	0,005			-0,009		
Occupational change	-0,007			-0,022		
Hours of work	0,005***			0,004**		
Tenure	0,004*			0,005		
Tenure ²	-0,000+			-0,000		
1997	0,002			-0,007		
1998	0,011*			0,010		
Constant	6,958***			6,748***		
F	11,61***			3,09**		
N (observations)	15495			3525		
N (persons)	5165			1175		

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: $p < 0,1$; *: $p < 0,05$; **: $p < 0,01$; ***: $p < 0,001$ (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by region and age

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	Western Germany			Eastern Germany		
	Overall	Age 20–44	Age 45–64	Overall	Age 20–44	Age 45–64
Training (1=yes)	0,024*	0,039**	-0,015	0,058*		
Firm change	0,005	0,006	0,012	-0,009		
Occupational change	-0,007	-0,008	-0,022	-0,022		
Hours of work	0,005***	0,004***	0,006***	0,004**		
Tenure	0,004*	0,001	0,008**	0,005		
Tenure ²	-0,000+	-0,000	-0,000*	-0,000		
1997	0,002	0,010+	-0,006	-0,007		
1998	0,011*	0,021**	0,002	0,010		
Constant	6,958***	6,955***	6,965***	6,748***		
F	11,61***	7,15***	5,95***	3,09**		
N (observations)	15495	9305	6190	3525		
N (persons)	5165	3265	2223	1175		

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: $p < 0,1$; *: $p < 0,05$; **: $p < 0,01$; ***: $p < 0,001$ (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by region and age

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	Western Germany			Eastern Germany		
	Overall	Age 20–44	Age 45–64	Overall	Age 20–44	Age 45–64
Training (1=yes)	0,024*	0,039**	-0,015	0,058*	0,063	0,053
Firm change	0,005	0,006	0,012	-0,009	-0,004	-0,017
Occupational change	-0,007	-0,008	-0,022	-0,022	-0,013	-0,027
Hours of work	0,005***	0,004***	0,006***	0,004**	0,003+	0,004*
Tenure	0,004*	0,001	0,008**	0,005	0,010	0,006
Tenure ²	-0,000+	-0,000	-0,000*	-0,000	-0,000	-0,000
1997	0,002	0,010+	-0,006	-0,007	-0,003	-0,009
1998	0,011*	0,021**	0,002	0,010	0,014	0,005
Constant	6,958***	6,955***	6,965***	6,748***	6,727***	6,745***
F	11,61***	7,15***	5,95***	3,09**	1,95*	1,67
N (observations)	15495	9305	6190	3525	2159	1366
N (persons)	5165	3265	2223	1175	759	499

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: $p < 0,1$; *: $p < 0,05$; **: $p < 0,01$; ***: $p < 0,001$ (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by Initial Schooling Levels

Introduction	Existing Research	Data & Methods	Empirical Findings	Discussion
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	CASMIN 1a–1c		CASMIN 2a–2cvoc		CASMIN 3a, 3b	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Training (1=yes)						
Amount of training						
Firm change						
Occupational change						
Hours of work						
Tenure						
Tenure ²						
1997						
1998						
Constant						
F						
N (observations)						
N (persons)						

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).
Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by Initial Schooling Levels

	Introduction		Existing Research		Data & Methods		Empirical Findings		Discussion	
	CASMIN 1a–1c		CASMIN 2a–2cvoc		CASMIN 3a, 3b					
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2		
Training (1=yes)	0,050*		0,031+		0,028					
Amount of training										
Firm change	-0,001		-0,018		0,031					
Occupational change	0,009		-0,010		-0,034					
Hours of work	0,006***		0,005***		0,004***					
Tenure	0,003		0,003		0,011*					
Tenure ²	-0,000		-0,000		-0,000*					
1997	0,001		0,005		-0,007					
1998	0,011+		0,013*		0,010					
Constant	6,805***		6,835***		7,311***					
F	5,81***		5,72***		3,94***					
N (observations)	7831		7959		3230					
N (persons)	2807		2884		1164					

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).

Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by Initial Schooling Levels

	Introduction		Existing Research		Data & Methods		Empirical Findings		Discussion	
	CASMIN 1a–1c		CASMIN 2a–2cvoc		CASMIN 3a, 3b					
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Training (1=yes)	0,050*	0,046*	0,031+	0,035+	0,028	0,009				
Amount of training		0,004		-0,002		0,011*				
Firm change	-0,001	-0,002	-0,018	-0,018	0,031	0,030				
Occupational change	0,009	0,009	-0,010	-0,010	-0,034	-0,032				
Hours of work	0,006***	0,006***	0,005***	0,005***	0,004***	0,004***				
Tenure	0,003	0,003	0,003	0,003	0,011*	0,010*				
Tenure ²	-0,000	-0,000	-0,000	-0,000	-0,000*	-0,000*				
1997	0,001	0,001	0,005	0,005	-0,007	-0,008				
1998	0,011+	0,011+	0,013*	0,013*	0,010	0,007				
Constant	6,805***	6,804***	6,835***	6,835***	7,311***	7,307***				
F	5,81***	5,17***	5,72***	5,09***	3,94***	4,08***				
N (observations)	7831	7831	7959	7959	3230	3230				
N (persons)	2807	2807	2884	2884	1164	1164				

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).

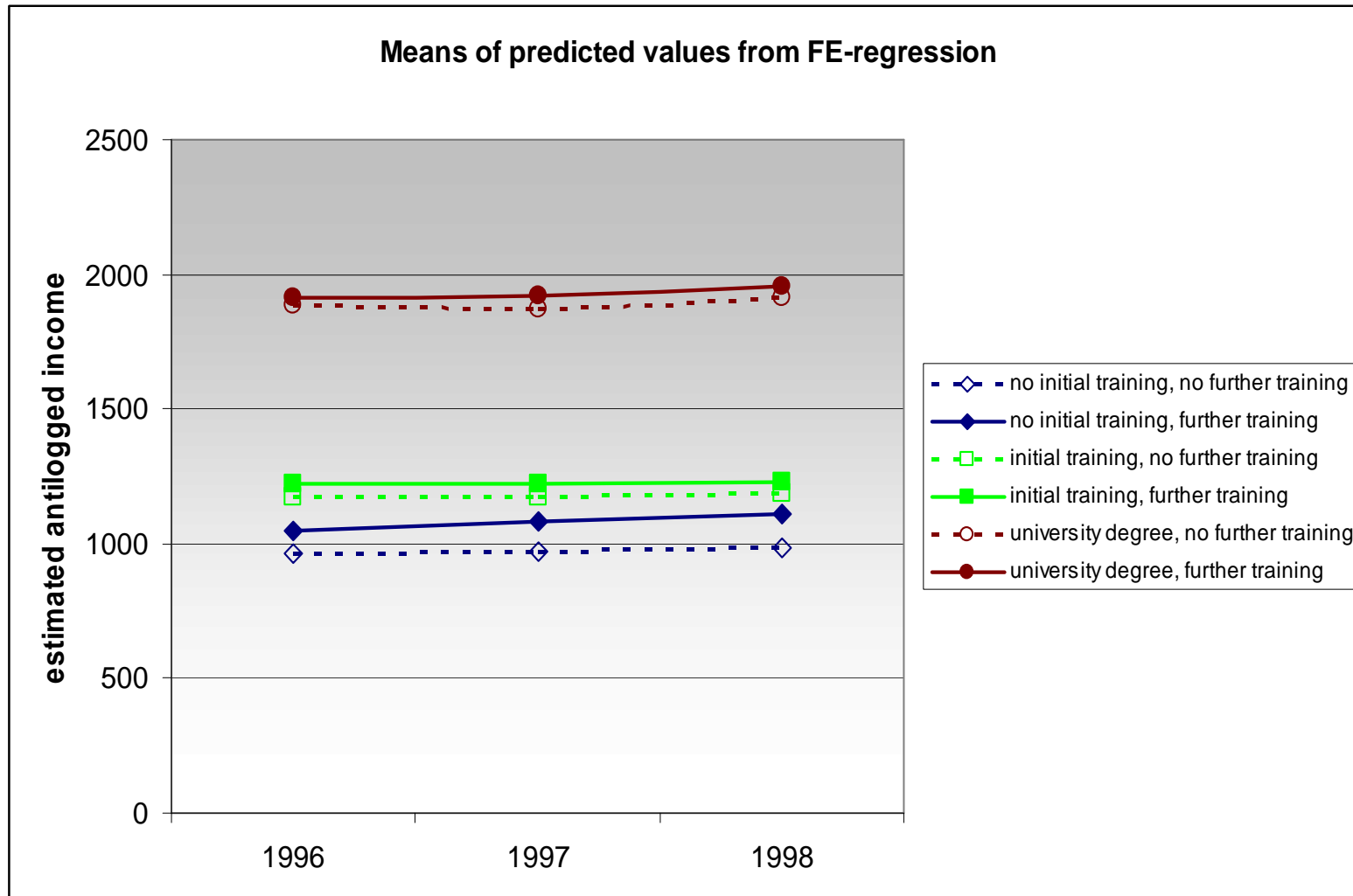
Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by Initial Training Levels

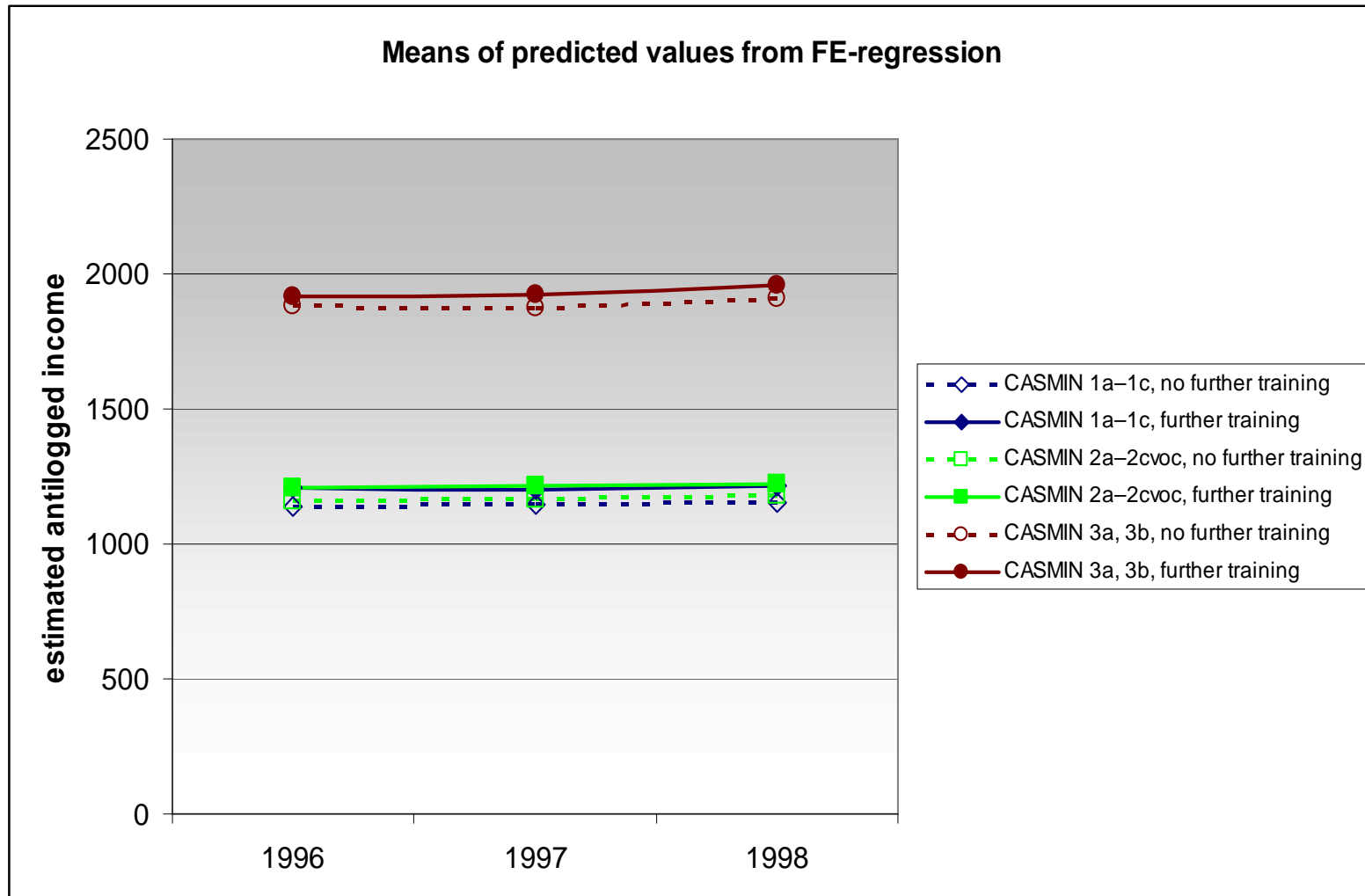
	Introduction		Existing Research		Data & Methods		Empirical Findings		Discussion	
	No initial voc. training		Initial voc. training		University degree					
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Training (1=yes)	0,086	0,051	0,037**	0,039**	0,028	0,009				
Amount of training		0,012		-0,001		0,011*				
Firm change	-0,073	-0,069	-0,005	-0,005	0,031	0,030				
Occupational change	0,054	0,046	-0,009	-0,009	-0,034	-0,032				
Hours of work	0,007**	0,007**	0,005***	0,005***	0,004***	0,004***				
Tenure	0,002	0,002	0,004*	0,004*	0,011*	0,010*				
Tenure ²	-0,000	-0,000	-0,000*	-0,000*	-0,000*	-0,000*				
1997	0,007	0,007	0,002	0,002	-0,007	-0,008				
1998	0,028	0,028	0,008+	0,008+	0,010	0,007				
Constant	6,636***	6,631***	6,847***	6,847***	7,311***	7,307***				
F	2,12*	1,86+	8,46***	7,53***	3,94***	4,08***				
N (observations)	1451	1451	14339	14339	3230	3230				
N (persons)	671	671	5011	5011	1164	1164				

Fixed-Effects-Models. Unstandardised regression coefficients. Dependent variable: ln of inflation-adjusted personal net income. Levels of significance: +: p < 0,1; *: p < 0,05; **: p < 0,01; ***: p < 0,001 (robust standard errors).
Source: Microcensus-Panel 1996–1998 (unweighted), own analysis.

Income Effects by Initial Training Levels



Income Effects by Initial Schooling Levels



Reinforcement or compensation of qualification-related inequalities?

- **As expected: pronounced selection effect due to unobserved heterogeneity**
- **Altogether: little or no income effects of vocational further training**
- **Results are consistent with findings from GSOEP-analyses**
- **Training effects vary by examined group/population**
- **Compared to income chances by initial qualification levels, further training returns have little impact**
- **Existing inequalities are not altered to a great extent**
- **Qualification-related inequalities:**
 - although reproduced by the highly selective access to further training,
 - they are not reinforced to a great extent because of the small training returns
- **„Boosting-thesis“ has – in our view – to be relativized**

- **Endogeneity-problems: selection bias due to time-varying variables (e.g. income dynamics) was not controlled for**
 - Fixed-Growth-Models
 - Random Growth-Models
 - Instrumental variables (not feasible with the MCP)
 - Matching
 - Time-lag-variables (Heckman/Hotz 1987)
 - ➔ Difficult with only three waves in the MCP
- **Importance and Treatment of mobility bias**
- **New Microcensus-Panel 2001–2004**
 - No replication possible due to design issues of the „supplement sample“

Thank you!

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