

# Estimates of Individual Returns to Additional Training Constrained by Internal Labour Market Mobility

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1 Introduction

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**1** Introduction

## 2 Literature Review

## 3 Data

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## Motivation

- What do employer and employee expect from additional professional training (APT)?
  - Do you really believe that this lecture increases your earnings?
  - How could you estimate the results?

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## What do we know working in a firm?

- **Internal labour market vs. “black box”...**
- We know everything about workers' internal mobility and know nothing about the outside
- What is the link between APT of workers, organised by firm, and workers' wages inside the same firm?

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# Hypothesis

In cases of limited number of offers of external working places

wages rise significantly after the APTs<sup>a</sup> which rise the intra-firm mobility

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<sup>a</sup> additional professional training

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## OLS estimates of Mincerian earnings functions (De Beyer, 1990)

APT was **insignificant** for skilled manual workers of some Kenyan and Tanzanian enterprises in 1980

### Hypotheses

- training does not raise productivity
- productivity raises, but wages do not
- APT is significant, but not related to wages



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- 3 APT's dummies do not reflect wage raise



- 1 false
- 2 training costs could be covered by the difference between new productivity and old wage level
- 3 if workers with lower wages have got training, their wages are equal to the highly paid workers' wages

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# What do we measure?

## De Beyer (1990)

The reasons of observable causality of formal training and workers' wages:

- *participation effect*
  - stable full-time working hours
  - short unemployment spell
- *access to jobs*
- *wage effect*

● worker finds her productivity level appropriate

● encouragement to learn more in the firm

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→ worker thinks that his productivity was increased  
→ overcompensation to some degree in the labor market

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## De Beyer (1990)

- *participation effect*  
was not measured for lack of corresponding data
- *access to jobs*  
is present in her estimates as mobility
- *wage effect*  
was confirmed

# Productivity vs. wages

	Elasticity of ...	
	... productivity...	... wages...
	... on a share of workers completed APTs	
Great Britain 1983–1996 (Dearden et al., 2000)	2	0.6
Italy 1996–1999 (Conti, 2005)	0.4	0.1

## Firms' preferences

Additional training has two sides: supply and demand.

- This was noticed, for example, in [\(Harris, 1999\)](#).  
He revealed that workers with the higher tenure had a greater probability to be trained
- [Harris \(1999\)](#) confirmed the hypothesis that large firms are less anxious to lose male worker after training, for women the opposite effect is observed

## Gender

There are gender differences in participation in training programs by countries and time.

- [Bills and Hodson \(2007\)](#) discovered growth of women's demand of APTs in the USA
- According to [Arulampalam et al. \(2004\)](#) the same is observed in Denmark, Finland, Italy and Spain
- In Sweden women less often (in comparison with men) use the system of APT and have smaller compensation after additional training ([Evertsson, 2004](#))

Different results for returns:

- the effect for men was more pronounced than that on women ([Pischke, 2001](#); [Budria and Pereira, 2007](#))
- [Parent \(2003\)](#) received the opposite result

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# Endogeneity

- effect of APT in earnings function is **overestimated** due to higher abilities of these workers who were involved in and completed APT (Barnow, 1986; Bartel, 1995; Albert et al., 2010)
- positive correlation of abilities with the amount of APTs (Parent, 2003; Arulampalam et al., 2004; Bills and Hodson, 2007)




## Endogeneity control

- first differences with individual fixed effects (Bartel, 1995)<sup>1</sup>
- difference in differences (Leuven and Oosterbeek, 2008) and triple differences (Travkin, 2014)
- ability as explanatory variable (Barron et al., 1999)
- IV estimates (Wooldridge, 2010)<sup>2</sup>

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<sup>1</sup> data on a single firm

<sup>2</sup>  trade-off between exogeneity and relevance conditions for instruments

 IV estimates of return to education are often higher than OLS estimates Card (2001)

## Insignificant return to training

[Albert et al. \(2010\)](#) used first difference (two periods) individual and workplaces (as mobility control) fixed effects estimates of earnings functions.

Insignificant return to training was obtained.

The same result was observe in the case of narrowing of the control group ([Leuven and Oosterbeek, 2008](#)).

## Individual trends

### Pischke (2001)

$$\ln w_{it} = x'_{it}\beta + \delta D_{it} + \alpha_i + \gamma_i t + \varepsilon_{it} \quad (1)$$

$w_{it}$  is  $i$ -s employee wage in the period  $t$

$x_{it}$  is column–vector of control and explanatory variables

$\beta$  is column–vector of parameters

$D$  is additional training variable (binary or cumulative)

$\delta$  individual return to training

$\alpha_i$  is time invariant individual unobservable effect (it may be correlated with  $x$  and  $D$ )

$\varepsilon_{it}$  is individual unobservable effect that could be different for employees and in time

$\gamma_i$  is an individual trend parameter

## Individual trends

Pischke (2001) analysed returns to training in Germany (German Socioeconomic Panel, 1986–1989).

- Training undertaken during leisure time has greater return than workplace training.

It was explained by the shortening of working hours.

## Russia (1994–1996, and 1998)

Berger et al. (2001) discovered higher returns to retraining for employment in new fields of job in contrast to training in the worker's current field.<sup>3</sup>

Berger et al. (2001) explained this by the peculiarities of transition economy.

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<sup>3</sup> on the basis of the Russia Longitudinal Monitoring Survey - Higher School of Economics (RLMS-HSE), <http://www.hse.ru/en/rlms/>

# Russia

Heads of about thousand Russian industrial enterprises were interviewed by [Denisova et al. \(2011\)](#).

- Russian state programs of professional training do not always cope with demand of the enterprises for the general and branch training
- The employer is ready to bear costs of training of the worker only if the worker does not leave the enterprise after training

# Russia

Travkin (2014) estimates individual returns to training on the RLMS-HSE data of 2004–2011.<sup>4</sup>

- The size of returns to APT depends on worker's individual abilities reflected by his place in wages distribution

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<sup>4</sup> It is hardly possible to identify what retraining and rise of qualification are with the use of the RLMS-HSE questionnaires.

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## Enterprise

A large metallurgical enterprise, organized 70 years ago at a distance of 50 km from the regional centre (open joint-stock company since 1992)

Year	2006	2007	2008	2009	2010
Production, tonnes	49720	51894	33550	25935	35133
Gross profit from sales, thousands of rubles	185947	263162	494535	343296	511019
Net profit, thousands of rubles	2323	2884	53498	-75640	117694
Wages fund, thousands of rubles	127167	143330	164009	160814	187396
Average nominal monthly wages, rubles	10774	12201	15018	14914	17142
Average real monthly wages, rubles of January 2006	10550	11162	11459	10116	10812

## Personnel records (monthly data)

We use information on the personnel of the enterprise, collected in February–June 2011 for the period of 2006–2010 from the following sources:

- personal cards of workers from personnel department
- log-books of additional training and personnel certification
- archival data about dismissed workers
- accounting reports of workers' wages
- lists of workers and non-production personnel of payroll department

## Categories of employees (number and percentage)

Year	2006	2007	2008	2009	2010
Apprentices <sup>5</sup>	32 3.0%	22 2.1%	15 1.5%	8 0.8%	18 1.9%
Non-skilled workers	239 22.3%	235 22.0%	228 22.7%	220 22.9%	204 21.4%
Supporting staff	143 13.3%	149 13.9%	143 14.2%	132 13.7%	122 12.8%
Skilled professionals	60 5.6%	63 5.9%	58 5.8%	50 5.2%	54 5.7%
Skilled workers	469 43.7%	484 45.2%	450 44.8%	447 46.4%	447 47.0%
Supervisors	91 8.5%	89 8.3%	88 8.8%	85 8.8%	85 8.9%
Middle management	20 1.9%	18 1.7%	18 1.8%	17 1.8%	18 1.9%
Top management	19 1.8%	10 0.9%	4 0.4%	4 0.4%	4 0.4%
Total	1073 100%	1070 100%	1004 100%	963 100%	952 100%

<sup>5</sup> They were excluded in the empirical part of the research.

## APTs

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Retraining	Rise of qualification <sup>6</sup>
crane, auto- and electric loader driver; technician; mechanic; electrician; sling operator; crusher operator; assistant chemist; cleaner; furnace tender; dogger; machine operator; press operator; shearer; electric and gas welder; burner; forging press operator	ecological and radiological safety; preparation on the right of work on dangerous waste and cargoes; mobilization preparation; transport and customs logistics; safety of traffic; safety of welding engineering; course of nurse

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<sup>6</sup> the mandatory programs of training regulated by the labour legislation, the safety precautions, labour safety, and Russian Federal Service for Ecological, Technical and Atomic Supervision

## APTs (retraining / rise of qualification)<sup>7</sup>

Year	2006	2007	2008	2009	2010
Non-skilled workers	36 / 0 15% / 0%	18 / 0 8% / 0%	19 / 0 8% / 0%	9 / 1 4% / 0%	10 / 2 5% / 1%
Supporting staff	5 / 2 3% / 1%	8 / 5 5% / 3%	2 / 3 1% / 2%	3 / 5 2% / 4%	1 / 8 1% / 7%
Skilled professionals	0 / 4 0% / 7%	0 / 6 0% / 10%	0 / 6 0% / 10%	1 / 6 2% / 12%	0 / 5 0% / 9%
Skilled workers	100 / 1 21% / 0%	51 / 1 11% / 0%	53 / 2 12% / 0%	44 / 0 10% / 0%	23 / 7 5% / 2%
Supervisors	1 / 16 1% / 18%	2 / 13 2% / 15%	0 / 27 0% / 31%	0 / 14 0% / 16%	0 / 24 0% / 28%
Middle management	0 / 6 0% / 30%	1 / 5 6% / 28%	1 / 10 6% / 56%	0 / 9 0% / 53%	0 / 6 0% / 33%
Top management	0 / 3 0% / 16%	0 / 0 0% / 0%	0 / 3 0% / 75%	0 / 2 0% / 50%	0 / 2 0% / 50%

<sup>7</sup> percentage in the total employed in the appropriate category

## Duration of APT (months), 2006–2010

Cumulative training (months)	Retraining		Rise of qualification	
	Men, <i>N</i>	Women, <i>N</i>	Men, <i>N</i>	Women, <i>N</i>
0	566	537	682	589
1	127	75	44	33
2	59	17	14	12
3	7	9	17	4
5	2	1	2	1
6			2	
7		1		
8				1

## Wages

The majority of APTs were carried out during work.

The workers lose in working hours and wages during the APTs, but in the month of completion the training or in the subsequent 1–2 months some of them received considerable one-time payments.

Only 18 episodes of retraining and 5 episodes of rise of qualification were off-the-job.

The corresponding employees received average monthly wages.

## Age and experience (in years) of trained workers in 2006–2010

	Retraining				Rise of qualification			
	Men		Women		Men		Women	
	Age	Expe- rience	Age	Expe- rience	Age	Expe- rience	Age	Expe- rience
Mean	28.6	2.3	30.9	3.5	43.1	14.5	42.8	12.3
Standard error of mean	0.6	0.3	0.7	0.5	1.0	0.8	1.1	1.1
Median	24	0	29	1	44	14	44	10
Minimum	16	0	17	0	20	0	21	0
Maximum	56	29	58	30	65	37	64	42



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## OLS estimates of earnings functions I

Dependent variable is logarithm of hourly real wages (in prices of January 2006) averaged over the year for each worker.

*Retraining* and *Rise of qualification* are the binaries. Index  $t - 1$  means lagged value (training was in a previous year).

*Tenure* is years of intra-firm experience.

Base category for the levels of education (binaries) is *Complete secondary education*.

The base category for position is *Non-skilled worker*.

*Auxiliary* and *Supporting* are the binaries for industrial divisions.

Work in the *Basic manufacture* is a base category in classification of industrial divisions.

	Men				Women			
	2007	2008	2009	2010	2007	2008	2009	2010
Retraining $_{t-1}$	0.081 (0.062)	-0.020 (0.089)	-0.093 (0.070)	-0.064 (0.056)	0.104** (0.045)	0.029 (0.071)	0.112* (0.063)	-0.037 (0.075)
Rise of qualification $_{t-1}$	-0.096 (0.066)	0.164 (0.133)	-0.054 (0.069)	0.075 (0.082)	0.204 (0.141)	0.017 (0.130)	0.174 (0.121)	-0.018 (0.124)
Tenure (years)	0.020***	0.011*	0.011*	0.017**	0.002	-0.002	0.006	0.003

## OLS estimates of earnings functions II

	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)
Tenure <sup>2</sup> /100	-0.049***	-0.023	-0.023	-0.046**	0.003	0.014	-0.003	-0.010
	(0.017)	(0.018)	(0.018)	(0.019)	(0.020)	(0.017)	(0.019)	(0.016)
Married	0.021	0.075	0.043	-0.016	-0.011	0.048	0.011	0.011
	(0.054)	(0.048)	(0.045)	(0.043)	(0.049)	(0.044)	(0.053)	(0.042)
# of children	-0.006	-0.035*	-0.018	0.017	-0.014	-0.037	-0.065**	-0.019
	(0.024)	(0.021)	(0.020)	(0.022)	(0.025)	(0.026)	(0.026)	(0.023)
Incomplete secondary education	-0.100*	-0.067*	-0.079**	-0.142***	-0.036	0.009	-0.011	0.027
	(0.051)	(0.040)	(0.038)	(0.049)	(0.040)	(0.047)	(0.049)	(0.046)
Vocational school	-0.142**	-0.027	-0.046	-0.014	-0.130***	-0.110**	0.020	-0.019
	(0.057)	(0.052)	(0.064)	(0.066)	(0.043)	(0.048)	(0.087)	(0.068)
Technical school	0.116	0.150**	0.107*	0.102*	0.073	0.031	0.044	0.050
	(0.073)	(0.064)	(0.056)	(0.058)	(0.047)	(0.052)	(0.055)	(0.045)
Incomplete higher education	-0.011	0.093	0.280	0.277**	-0.010	-0.004	-0.236***	-0.025
	(0.408)	(0.191)	(0.261)	(0.108)	(0.107)	(0.282)	(0.079)	(0.168)
Higher education	0.031	0.161	0.110	0.163*	0.302***	0.272***	0.305***	0.400***
	(0.079)	(0.139)	(0.085)	(0.088)	(0.108)	(0.092)	(0.087)	(0.074)
Supporting staff	0.445***	0.488***	0.460***	0.622***	0.121**	0.116**	0.109*	0.161***
	(0.150)	(0.156)	(0.151)	(0.156)	(0.051)	(0.054)	(0.060)	(0.048)

## OLS estimates of earnings functions III

Skilled profes- sionals	0.458** (0.199)	0.532*** (0.186)	0.530*** (0.175)	0.499** (0.194)	0.122 (0.092)	0.221** (0.087)	0.189** (0.089)	0.187** (0.085)
Skilled worker	0.481*** (0.105)	0.522*** (0.094)	0.528*** (0.108)	0.528*** (0.094)	0.243*** (0.043)	0.226*** (0.044)	0.155*** (0.055)	0.273*** (0.050)
Supervisors	0.929*** (0.132)	0.860*** (0.130)	0.893*** (0.127)	0.866*** (0.111)	0.749*** (0.118)	0.939*** (0.119)	0.748*** (0.114)	0.865*** (0.095)
Middle manage- ment	1.142*** (0.177)	1.018*** (0.192)	1.130*** (0.174)	1.058*** (0.145)	0.876*** (0.185)	1.207*** (0.214)	1.073*** (0.191)	1.096*** (0.165)
Top manage- ment	1.495*** (0.145)	1.445*** (0.157)	1.424*** (0.141)	1.330*** (0.133)				
Auxiliary	-0.388*** (0.046)	-0.368*** (0.035)	-0.460*** (0.034)	-0.397*** (0.040)	-0.259*** (0.044)	-0.241*** (0.040)	-0.275*** (0.045)	-0.340*** (0.040)
Supporting	-0.297*** (0.085)	-0.472*** (0.084)	-0.382*** (0.099)	-0.477*** (0.079)	-0.237*** (0.054)	-0.243*** (0.053)	-0.174*** (0.060)	-0.174*** (0.049)
Constant	4.108*** (0.106)	4.160*** (0.096)	4.058*** (0.118)	4.105*** (0.101)	3.991*** (0.051)	3.990*** (0.063)	3.872*** (0.072)	3.861*** (0.057)
<i>N</i>	422	417	407	428	411	410	396	382
Adj. $R^2$	0.52	0.52	0.58	0.51	0.40	0.42	0.35	0.52
$F$ -st.	43.6	42.0	65.8	50.6	16.9	16.8	18.5	27.9

Heteroskedasticity-consistent standard errors ( $HC_3$ ) in parentheses

(Davidson and MacKinnon, 2003)

\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## OLS estimates of earnings functions with *cumulative training* I

Dependent variable is logarithm of hourly real wages (in prices of January 2006) averaged over the year for each worker.

*Cumulative training* of the worker (number of months) is used as explanatory variable.

	Men				Women			
	2007	2008	2009	2010	2007	2008	2009	2010
Retraining (cumulative)	0.026 (0.033)	0.047* (0.028)	0.039 (0.024)	0.032 (0.024)	0.058 (0.038)	0.073** (0.033)	0.035 (0.037)	0.031 (0.027)
Rise of qualification (cumulative)	-0.047 (0.070)	0.007 (0.042)	0.001 (0.032)	0.033 (0.030)	0.140** (0.061)	0.055 (0.042)	0.062 (0.042)	0.036 (0.029)
Tenure (years)	0.026*** (0.005)	0.024*** (0.005)	0.024*** (0.005)	0.031*** (0.006)	0.011* (0.006)	0.008 (0.006)	0.015** (0.007)	0.007 (0.006)
Tenure <sup>2</sup> /100	-0.064*** (0.016)	-0.057*** (0.016)	-0.054*** (0.014)	-0.078*** (0.016)	-0.020 (0.018)	-0.011 (0.018)	-0.024 (0.020)	-0.016 (0.016)
Married	0.056 (0.045)	0.102** (0.042)	0.069* (0.039)	0.016 (0.043)	0.003 (0.041)	0.017 (0.043)	0.006 (0.048)	0.017 (0.041)
# of children	-0.011 (0.023)	-0.026 (0.021)	-0.004 (0.019)	0.019 (0.021)	-0.026 (0.022)	-0.045* (0.024)	-0.053** (0.026)	-0.028 (0.021)
Incomplete secondary education	-0.134***	-0.085**	-0.087**	-0.138***	-0.046	-0.013	-0.012	0.041

## OLS estimates of earnings functions with *cumulative training* II

Vocational school	(0.045) -0.127**	(0.043) -0.056	(0.041) -0.089*	(0.045) -0.011	(0.050) -0.118**	(0.052) -0.090	(0.058) -0.000	(0.049) -0.032
Technical school	(0.054) 0.081	(0.051) 0.126**	(0.047) 0.086*	(0.052) 0.076	(0.056) 0.066	(0.057) 0.045	(0.064) 0.043	(0.056) 0.060
Incomplete higher education	(0.056) -0.151	(0.053) 0.137	(0.050) 0.459**	(0.054) 0.333	(0.047) 0.040	(0.049) -0.018	(0.054) -0.245	(0.046) -0.056
Higher education	(0.263) 0.030	(0.250) 0.156**	(0.192) 0.097	(0.210) 0.132*	(0.207) 0.295***	(0.257) 0.260***	(0.282) 0.299***	(0.233) 0.399***
Supporting staff	(0.078) 0.385***	(0.076) 0.418***	(0.069) 0.395***	(0.073) 0.602***	(0.068) 0.105**	(0.067) 0.128***	(0.072) 0.133***	(0.061) 0.172***
Skilled professionals	(0.114) -0.465***	(0.113) 0.503***	(0.116) 0.439***	(0.122) 0.507***	(0.046) 0.132*	(0.046) 0.227***	(0.051) 0.230***	(0.043) 0.218***
Skilled worker	(0.135) 0.438***	(0.138) 0.416***	(0.130) 0.419***	(0.139) 0.456***	(0.074) 0.240***	(0.077) 0.258***	(0.085) 0.169***	(0.070) 0.282***
Supervisors	(0.071) 0.876***	(0.065) 0.768***	(0.068) 0.805***	(0.071) 0.801***	(0.052) 0.822***	(0.054) 0.943***	(0.062) 0.748***	(0.052) 0.857***
Middle management	(0.100) 1.092***	(0.094) 0.934***	(0.091) 1.029***	(0.096) 1.018***	(0.083) 0.860***	(0.087) 0.991***	(0.098) 0.980***	(0.084) 1.112***
	(0.136)	(0.131)	(0.131)	(0.143)	(0.194)	(0.222)	(0.251)	(0.173)

## OLS estimates of earnings functions with *cumulative training* III

Top management	1.445***	1.325***	1.306***	1.254***				
	(0.161)	(0.194)	(0.187)	(0.205)				
Auxiliary	-0.385***	-0.356***	-0.412***	-0.420***	-0.300***	-0.197***	-0.278***	-0.352***
	(0.037)	(0.036)	(0.033)	(0.037)	(0.049)	(0.050)	(0.057)	(0.050)
Supporting	-0.325***	-0.425***	-0.352***	-0.499***	-0.270***	-0.204***	-0.198***	-0.188***
	(0.068)	(0.069)	(0.067)	(0.071)	(0.054)	(0.055)	(0.063)	(0.055)
Constant	4.095***	4.117***	3.991***	4.037***	3.945***	3.892***	3.781***	3.818***
	(0.079)	(0.074)	(0.079)	(0.086)	(0.060)	(0.062)	(0.072)	(0.064)
<i>N</i>	499	481	482	486	466	449	431	406
Adj. $R^2$	0.53	0.51	0.56	0.53	0.43	0.42	0.36	0.55
<i>F</i> -st.	30.4	27.4	33.4	30.1	20.9	19.3	14.6	28.5

Heteroskedasticity-consistent standard errors ( $HC_3$ ) in parentheses

(Davidson and MacKinnon, 2003)

\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## Cumulative training explanatory variables

- Cumulative variables estimate investments into the human capital more precisely.
- Returns to such investments cannot be observed instantly, the delay varies for different workers. The correct choice of lags of the binary variable, describing the fact of APT's completion, looks problematic.
- Before training, during the training and some time after it significant fluctuations of wages for some workers are observed. Attempting to use wages averaged with time window of several months long we have to include one more parameter in the model — width of the window, that reduces versatility of the results interpretation.
- Cumulative variables are better estimates of workers participation in several episodes of training.



## Unobservables

- Correlation of individual unobservable effects may be the reason of inconsistency of the OLS estimates
- [Travkin \(2014\)](#) has shown the presence of correlation of trends of wages of workers with different abilities, correlated with wages
- [De Beyer \(1990\)](#) has shown, that profiles of wages of trained and non-trained workers should be non-parallel

The model:

$$\ln w_{it} = x'_{it}\beta + D'_{it}\delta + \alpha_i + \gamma_it + \mu_t + \varepsilon_{it}, \quad (2)$$

where  $w_{it}$  is real (in roubles of January, 2006) hourly wage of worker  $i$  in month  $t$ ,  $D$  — vector-column of cumulative continuance of worker's APT during the spell till the month  $t$ ,  $\delta$  — vector-column of parameters,  $\mu_t$  — time fixed effect (unobservable), the other designations conform to the model (1).

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## FE estimates of earnings functions I

Time-invariant effects  $\alpha_i$  were excluded by the within transformation, individual trends  $\gamma_i$  and time fixed effects  $\mu_t$  are LSDV estimates (Verbeek, 2012).

	Men	Women
Retraining (cumulative)	0.173*** (0.022)	0.069*** (0.025)
Rise of qualification (cumulative)	0.044* (0.024)	0.039 (0.030)
Tenure (months)	0.011 (0.042)	0.009 (0.029)
Tenure <sup>2</sup> / 100	-0.024 (0.047)	-0.182 (0.130)
Married	-0.086 (0.160)	-0.466** (0.221)
# of children	0.073 (0.073)	-0.024 (0.189)
Incomplete Secondary Education	-0.400 (0.581)	
Vocational school	-0.529 (0.535)	
Technical school	-0.137 (0.524)	
Incomplete higher education	1.016** (0.449)	
Higher education		1.136***

## FE estimates of earnings functions II

		(0.434)
Supporting staff	-0.119 (0.125)	-0.023 (0.030)
Skilled professionals	-0.011 (0.103)	-0.010 (0.053)
Skilled worker	-0.027 (0.037)	-0.032 (0.036)
Supervisors	0.022 (0.052)	-0.062 (0.070)
Middle management	-0.016 (0.087)	0.065 (0.224)
Top management	-0.045 (0.110)	
Auxiliary	-0.202*** (0.047)	-0.050 (0.051)
Supporting	-0.316*** (0.075)	-0.129** (0.054)
$\gamma_{it}$	Yes	Yes
$\mu_t$	Yes	Yes
Constant	9.987 (8.944)	65.239 (43.504)
<hr/>		
$N$	23388	21758
Groups	752	619
$R^2$ within	0.133	0.107
$R^2$ between	0.015	0.018

## FE estimates of earnings functions III

$R^2$ overall	0.003	0.001
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Standard errors in parentheses

\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## Difference in differences estimates (DD columns) for retrained workers I

Natural logarithms of real annually averaged hourly wages of workers were estimated with the use of Stata module *diff*, created by [Villa \(2011\)](#).

The Kernel-based Propensity Score Matching with Epanechnikov kernel function (common support of the propensity score) was used.

Information on the intrafirm experience, marital status, number of children, education level, worker's structural division were used for the propensity score calculates.

<i>t</i>	Men				Women			
	<i>N</i>	$\ln w_t$	$\ln w_t - \ln w_t^+$	DD	<i>N</i>	$\ln w_t$	$\ln w_t - \ln w_t^+$	DD
2006 <sup>++</sup>	207 <sup>+</sup>	4.299 (0.028)	-0.060 (0.058)	0.158* (0.007)	151 <sup>+</sup>	3.801 (0.020)	0.075 (0.047)	0.069 (0.073)
	67	4.239 (0.051)			46	3.876 (0.043)		
2007	198 <sup>+</sup>	4.443 (0.032)	0.098 (0.070)		140 <sup>+</sup>	3.951 (0.030)	0.144 (0.051)	
	65	4.541 (0.064)			43	4.095 (0.043)		

## Difference in differences estimates (DD columns) for retrained workers II

2007 <sup>++</sup>	295 <sup>+</sup>	4.488 (0.026)	-0.325 <sup>***</sup> (0.083)	0.197 <sup>*</sup> (0.112)	129 <sup>+</sup>	3.902 (0.036)	-0.046 (0.074)	0.040 (0.110)
	37	4.163 (0.077)			23	3.856 (0.063)		
2008	284 <sup>+</sup>	4.586 (0.024)	-0.128 (0.082)		122 <sup>+</sup>	3.945 (0.034)	-0.005 (0.081)	
	33	4.458 (0.080)			22	3.940 (0.072)		
2008 <sup>++</sup>	226 <sup>+</sup>	4.496 (0.029)	-0.163 <sup>***</sup> (0.060)	0.137 (0.099)	168 <sup>+</sup>	3.876 (0.031)	0.017 (0.090)	0.127 (0.139)
	39	4.333 (0.053)			18	3.892 (0.085)		
2009	218 <sup>+</sup>	4.405 (0.028)	-0.026 (0.076)		155 <sup>+</sup>	3.777 (0.032)	0.144 (0.110)	
	36	4.379 (0.071)			18	3.921 (0.105)		
2009 <sup>++</sup>	246 <sup>+</sup>	4.361 (0.027)	-0.210 <sup>***</sup> (0.067)	0.208 <sup>**</sup> (0.091)	88 <sup>+</sup>	3.664 (0.038)	0.025 (0.118)	-0.124 (0.151)
	42	4.151 (0.063)			7	3.689 (0.113)		
2010	246 <sup>+</sup>	4.435 (0.029)	-0.002 (0.061)		81 <sup>+</sup>	3.773 (0.041)	-0.099 (0.094)	
	41	4.432 (0.052)			7	3.674 (0.084)		

## Difference in differences estimates (DD columns) for retrained workers III

+ — control group, ++ — year of training

Standard errors in parentheses

\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$



## Difference in differences estimates (DD columns) for workers trained in forms of rise of qualification I

Natural logarithms of real annually averaged hourly wages of workers were estimated with the use of Stata module *diff*, created by [Villa \(2011\)](#).

The Kernel-based Propensity Score Matching with Epanechnikov kernel function (common support of the propensity score) was used.

Information on the intrafirm experience, marital status, number of children, education level, worker's structural division were used for the propensity score calculates.

$t$	Men				Women			
	$N$	$\ln w_t$	$\ln w_t - \ln w_t^+$	DD	$N$	$\ln w_t$	$\ln w_t - \ln w_t^+$	DD
2006 <sup>++</sup>	70 <sup>+</sup>	4.784 (0.062)	0.262 (0.112)	-0.082 (0.155)	37 <sup>+</sup>	4.297 (0.090)	-0.047 (0.192)	0.030 (0.274)
	19	5.046 (0.091)			8	4.250 (0.161)		
2007	69 <sup>+</sup>	5.002 (0.056)	0.180* (0.102)		33 <sup>+</sup>	4.464 (0.111)	-0.016 (0.217)	
	19	5.182 (0.083)			8	4.448 (0.181)		

## Difference in differences estimates (DD columns) for workers trained in forms of rise of qualification II

2007++	52+	4.663 (0.073)	0.172 (0.202)	-0.082 (0.288)	111+	4.094 (0.049)	0.440 (0.184)	-0.168 (0.271)
	9	4.835 (0.193)			12	4.534 (0.178)		
2008	51+	4.746 (0.064)	0.090 (0.216)		102+	4.168 (0.050)	0.272 (0.211)	
	9	4.836 (0.199)			11	4.440 (0.206)		
<hr/>								
2008++	90+	4.689 (0.050)	0.417*** (0.090)	-0.100 (0.125)	21+	4.443 (0.130)	0.264 (0.243)	-0.101 (0.338)
	37	5.106 (0.073)			8	4.707 (0.203)		
2009	87+	4.623 (0.045)	0.317*** (0.086)		20+	4.391 (0.137)	0.163 (0.230)	
	37	4.939 (0.075)			8	4.554 (0.187)		
<hr/>								
2009++	28+	4.944 (0.079)	-0.217 (0.131)	0.119 (0.193)	175+	3.857 (0.035)	0.311 (0.205)	0.017 (0.284)
	15	4.727 (0.106)			11	4.168 (0.204)		
2010	28+	4.960 (0.089)	-0.098 (0.135)		167+	3.934 (0.038)	0.328 (0.203)	
	15	4.862			11	4.262		

## Difference in differences estimates (DD columns) for workers trained in forms of rise of qualification III

(0.100)

(0.199)

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+ — control group, ++ — year of training

Standard errors in parentheses

\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## Historical remark

The enterprise tried to increase wages of low-qualified workers (or poor paid workers) up to the level of the higher paid workers' wages.

As the result the OLS did not show the difference in wages of retrained and non-retrained workers.

1 Introduction

2 Literature Review

3 Data

4 Results

**5 Conclusions**

## Conclusions

- The majority of the results indicate the higher returns to retraining in comparison with the rise of qualification
  - Retraining gives much more possibilities for professional mobility accompanied with employment in a higher paid workplaces
  - The formal programs of training classified by us as rise of qualification are basically the mandatory types of APT without pecuniary bonuses, and they usually leave worker on the same step of professional ladder
- The considered effects are brighter expressed for men, than for women

## Historical comparison

The differences in returns to retraining and rise of qualification have been underlined earlier by [Berger et al. \(2001\)](#) on the Russian data (RLMS-HSE, 1996–1998).

- The separately taken enterprise repeats the laws observed in the economy as a whole
- It looks like the enterprise is “frozen” with the old problems of the out-of-date programs of training
- Continuous development could be supplemented with the APT as the one of its tools

Thank you !



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