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Managing Authority for  
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Ministry of Education, Science, Research  
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# Workers to job allocation – Case study of Central Europe countries

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National project: Improvement of higher vocational  
education

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# Motivation

- ▶ Projection of labour market structure
- ▶ Analysis of labour market determinants
- ▶ Demographic vs. market
  - demographic projections
  - EU-LFS
  - SNA

# Data I.

- ▶ Limited set of variables (supply side)
- ▶ Countries
  - Austria, Czech republic, Germany, Hungary, Poland, Slovakia
- ▶ Demographic characteristics
  - Sex
  - Age (4 age groups– 0–29,30–44,45–59,60+)
  - Region
  - Education:
    - Low– Lower secondary
    - Medium– Upper secondary
    - High– Third level

# Data II.

## ▶ EU-LFS

- Time span 2008–2011
  - NACE rev. 1 → NACE rev. 2
- Demographic characteristics
- Unemployment
- Sector employment growth rate

## ▶ SNA

- Average salaries

# Data– Economic sectors

1. Agriculture, forestry and fishery
2. Mining, gas, oil extraction and processing, energy industry
3. Manufacturing
4. Construction
5. Retail
6. Information and Telecommunication services
7. Finances
8. Real Estate
9. Administrative, scientific, technical and support services
10. Public services, education, health and social services
11. Arts, entertainment industry and other non–public service

# Data– Occupations

1. Managers
2. Professionals
3. Technicians and associate professionals
4. Clerical support workers
5. Service and sales workers
6. Skilled agricultural, forestry and fishery workers
7. Craft and related trades workers
8. Plant and machine operators and assemblers
9. Elementary occupations
10. Armed forces occupations

# Methodology

- ▶ Multinomial logistic regression:

- Sector equation:

$$\begin{aligned} \text{LOG} \left( \frac{P_{i,j,c}}{P_{i,1,c}} \right) = & \beta_{0,j,c} + \beta_{1,j,c} \text{GENDER}_{i,c,Dummy(2)} + \beta_{2,j,c} \text{AGE}_{i,c,Dummy(2-4)} \\ & + \beta_{3,j,c} \text{REGION}_{i,c,Dummy(2-x)} + \beta_{4,j,c} \text{EDU}_{i,c,Dummy(2-3)} + \beta_{5,c} \text{UR} \\ & + \beta_{6,j,c} W_{j,c} + \beta_{7,j,c} \text{SG}_{j,c} \end{aligned}$$

- Occupation equation

$$\begin{aligned} \text{LOG} \left( \frac{P_{i,k,c}}{P_{i,1,c}} \right) = & \beta_{0,k,c} + \beta_{1,k,c} \text{GENDER}_{i,c,Dummy(2)} + \beta_{2,k,c} \text{AGE}_{i,c,Dummy(2-4)} \\ & + \beta_{3,k,c} \text{REGION}_{i,c,Dummy(2-x)} + \beta_{4,k,c} \text{EDU}_{i,c,Dummy(2-3)} + \beta_{5,c} \text{UR} \\ & + \beta_{6,k,c} W_{j,c} + \beta_{7,k,c} \text{SG}_{j,c} \end{aligned}$$

# Estimation results

Country	Sector equation			Occupation equation	
	No. obs.	Pseudo R2	Log-likelihood	Pseudo R2	Log-likelihood
AT	357 855	0.9880	-391 014.61	0.2235	-26 860 262
CZ	329 527	0.9342	-2 514 793.	0.1898	-32 242 990
DE	89 697	0.9621	-11 511 040	0.1888	-2.597e+08
HU	397 439	0.9898	-299 793.98	0.2451	-24 406 090
PL	484 368	0.8869	-14 453 262	0.3241	-92 757 182
SK	170 077	0.9564	-788 944.56	0.1913	-1 561 2286



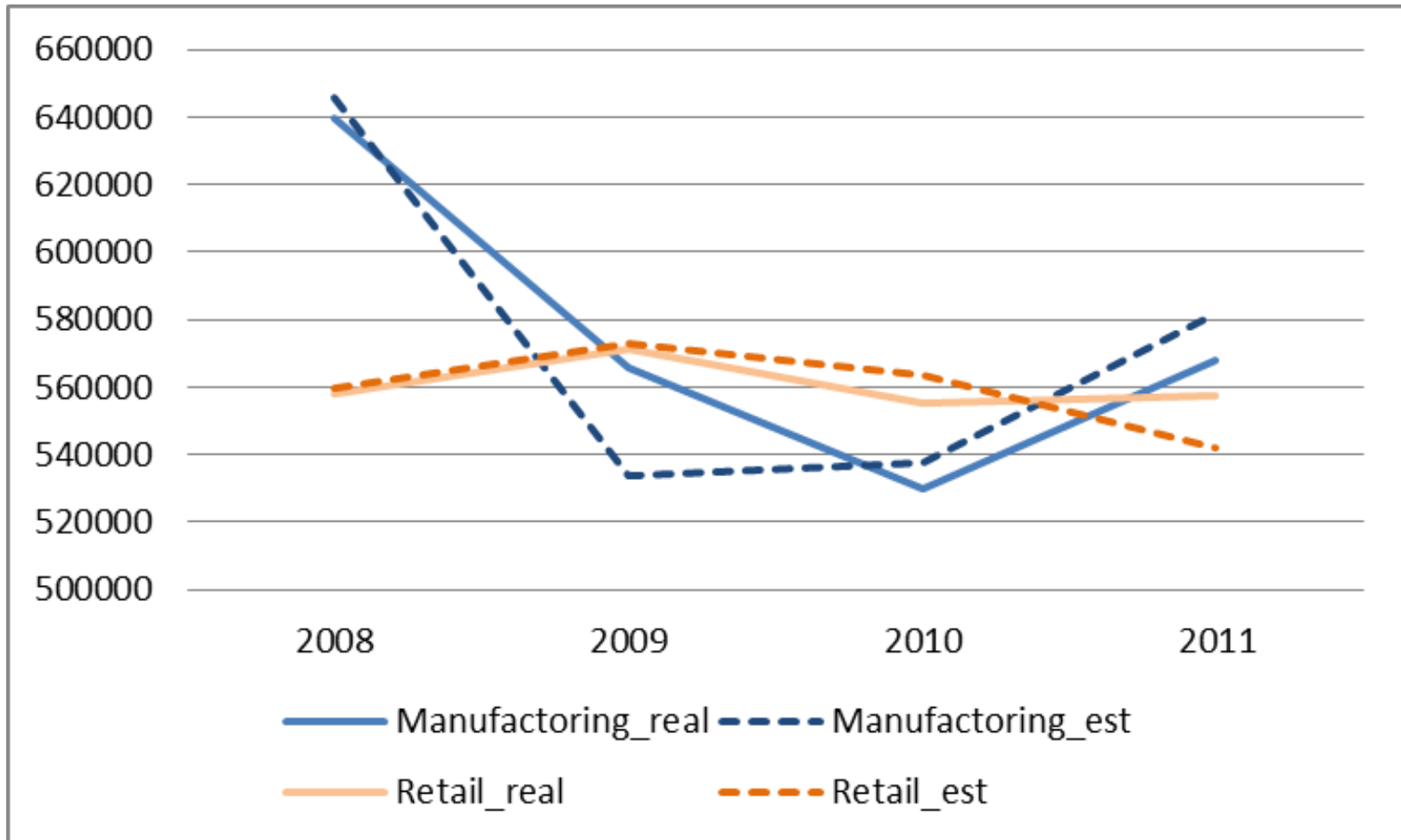
# Selected sectorial results – SK

Variable	Manufacturing		Retail	
	Coef.	Std. Err.	Coef.	Std. Err.
Female	7.707257	0.072001	2.042598	0.061948
30–44	–0.44036	0.063231	–0.47332	0.060392
45–59	–0.98853	0.06705	–0.93986	0.064175
60+	–1.76928	0.172454	–1.2531	0.165935
reg2	–0.70527	0.07539	–1.36235	0.072553
reg3	–0.64519	0.080998	–1.21224	0.077827
reg4	–0.85119	0.079458	–1.31433	0.076311
L_EDU_M	–0.95139	0.074624	–0.39029	0.072461
L_EDU_H	–0.76817	0.156985	–0.66132	0.153332
GS	–7.23482	0.311168	–76.8487	0.291774
HW	–14812.5	21.06867	–4565.46	12.25385
UR	–7.4813	0.040972	–1.80395	0.031998
cons	1100.078	1.707018	406.468	1.123846

# Sectorial marginal effects

	Manufacturing	Retail
Variable	dy/dx	dy/dx
Female	8.80E-12	-0.00031
30-44	1.24E-14	2.29E-05
45-59	-1.82E-14	-8.6E-05
60+	-1.53E-13	-0.00036
reg2	2.75E-13	0.000181
reg3	2.50E-13	0.000185
reg4	1.96E-13	0.000221
Medium	-1.79E-13	-0.00079
High	-3.84E-14	-0.00052
GS	2.61E-11	-0.02669
HW	-3.84E-09	3.198898
UR	-2.13E-12	0.000825

# Comparison of real and estimated employment by sector



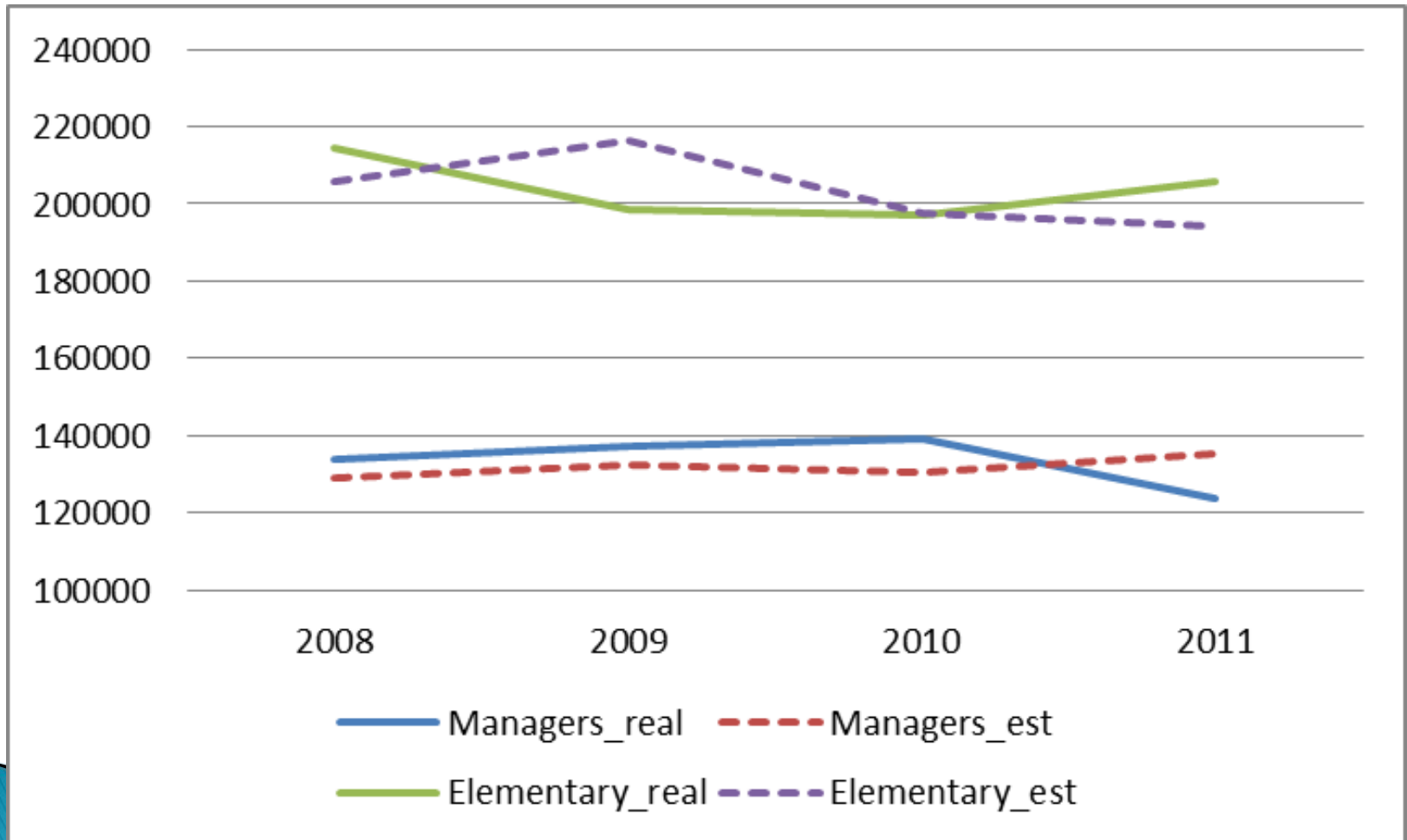
# Selected occupational results – SK

Variable	Managers		Elementary occup.	
	Coef.	Std. Err.	Coef.	Std. Err.
Female	3.286401	0.018215	2.614975	0.018348
30–44	0.257093	0.010121	0.228347	0.010514
45–59	1.602512	0.016297	1.854315	0.016522
60+	13.53798	18.58896	14.08354	18.58896
reg2	-0.8435	0.020252	-0.02252	0.020689
reg3	-1.63243	0.019549	-0.5609	0.020013
reg4	-1.8803	0.018976	-0.75967	0.019446
L_EDU_M	0.204544	0.010253	-2.75677	0.013901
L_EDU_H	18.0278	0.0282	22.3802	0.025275
GS	2.681513	0.019195	3.118695	0.019431
HW	46.71238	0.4154	94.42081	0.422135
UR	-0.17269	0.003263	-0.13226	0.0033
cons	3.427279	0.052811	-1.39589	0.053722

# Occupational marginal effects

	Managers	Elementary occup.
Variable	dy/dx	dy/dx
Female	-0.02813	-0.00904
30-44	0.050289	-0.00426
45-59	0.062993	0.014451
60+	0.090493	0.049351
reg2	-0.02583	0.021939
reg3	-0.03865	0.047155
reg4	-0.04562	0.050895
Medium	0.121372	-0.10121
High	-0.05718	0.430464
GS	-0.00868	0.026653
HW	0.704404	1.879356
UR	-0.00082	-0.00073

# Comparison of real and estimated employment by occupation



# Selected sectorial results – DE

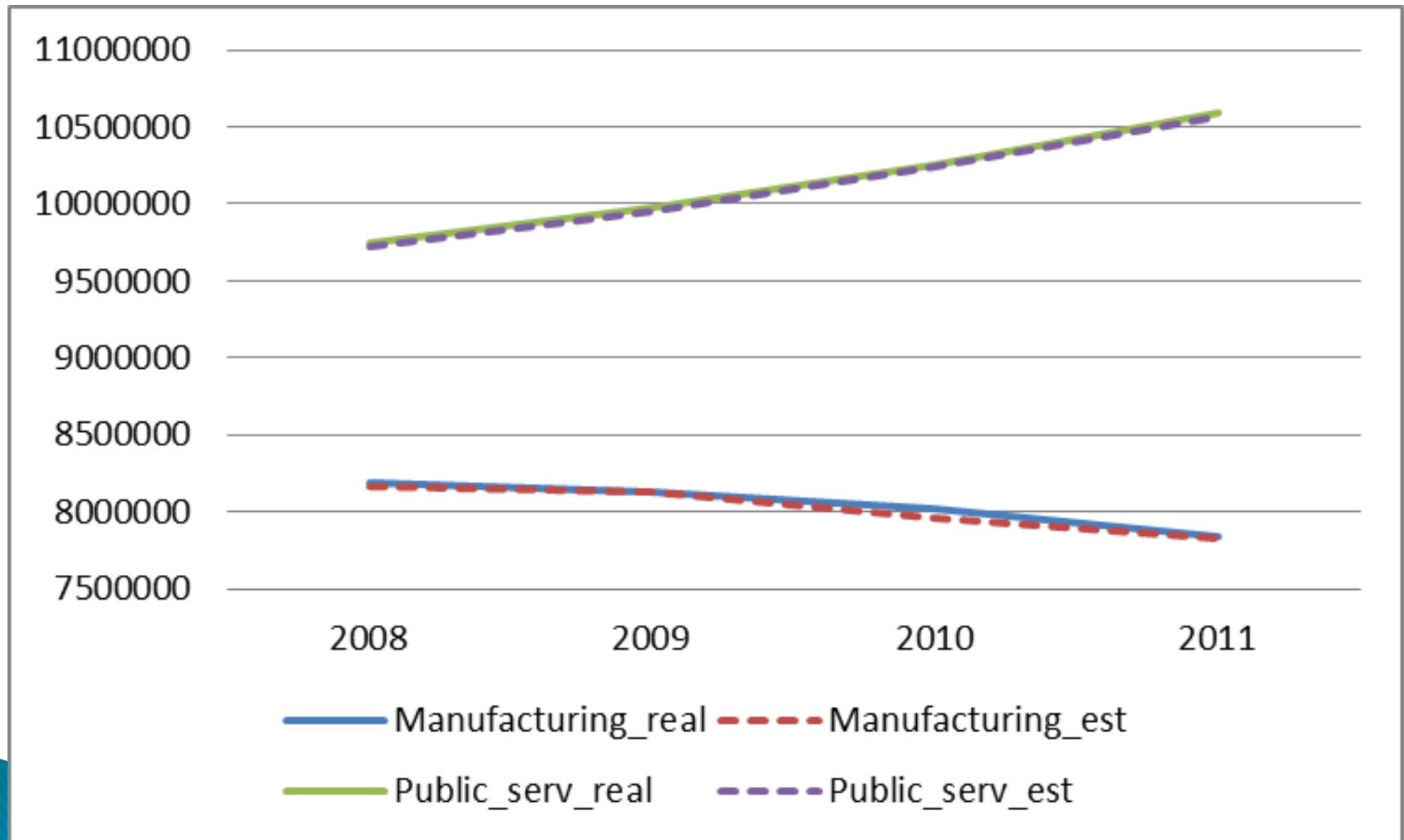
Variable	Manufacturing		Public services	
	Coef.	Std. Err.	Coef.	Std. Err.
Female	21.84934	0.195349	15.91686	0.075842
30-44	0.032998	0.093886	0.155596	0.065706
45-59	0.009055	0.09348	0.015158	0.064132
60+	-0.10882	0.155892	-0.2481	0.093685
reg2	-0.07333	0.121015	-0.08855	0.08455
reg3	-0.27754	0.205345	0.089637	0.119398
reg4	-0.00039	0.191781	0.073532	0.136038
reg5	0.594722	0.420083	0.678607	0.265692
reg6	-0.86922	0.273438	-0.5445	0.151352
reg7	-0.11238	0.153676	-0.00688	0.102287
reg8	-0.36194	0.25649	-0.38437	0.162241
reg9	0.065806	0.138612	0.126369	0.096799
reg10	-0.00038	0.11776	-0.01003	0.080672
reg11	0.200609	0.17334	0.09696	0.120832
reg12	0.377381	0.349561	0.256499	0.227065
reg13	0.227124	0.164526	0.244264	0.113965
reg14	0.274831	0.206767	0.36574	0.150729
reg15	0.034635	0.189826	-0.09727	0.133231
reg16	0.232467	0.213211	0.217535	0.144501
L_EDU_M	-1.4604	0.095618	-1.71993	0.052238
L_EDU_H	-0.04164	0.096024	-0.08362	0.072747
GS	333.1438	0.21991	7.060205	0.0838
HW	-52931.6	29.60211	-39619.9	43.08257
UR	37.74591	0.196685	28.49243	0.050572
cons	930.6399	1.548192	797.1199	0.796463

# Sectorial marginal effects

Variable	Manufacturing	Public services
	dy/dx.	dy/dx
Female	1.67E-58	1.62E-05
30-44	-1.04E-61	1.09E-06
45-59	1.29E-61	5.06E-07
60+	4.24E-62	-1.41E-06
reg2	1.01E-61	1.62E-07
reg3	-1.36E-60	-1.32E-06
reg4	8.83E-61	4.08E-06
reg5	-1.63E-61	4.26E-07
reg6	-1.99E-60	-4.68E-06
reg7	-5.72E-61	-8.20E-07
reg8	6.57E-61	1.91E-06
reg9	5.02E-62	9.03E-07
reg10	1.61E-61	4.27E-07
reg11	7.25E-61	1.07E-06
reg12	2.15E-61	-6.86E-07
reg13	8.95E-61	3.27E-06
reg14	6.29E-61	3.42E-06
reg15	1.13E-61	-1.11E-06
reg16	1.03E-60	3.26E-06
L_EDU_M	1.93E-61	-2.29E-06
L_EDU_H	1.61E-61	4.21E-08
GS	1.03E-36	-7E-05
HW	0	-0.09901
UR	1.29E-35	4.63E-05



# Comparison of real and estimated employment by sector



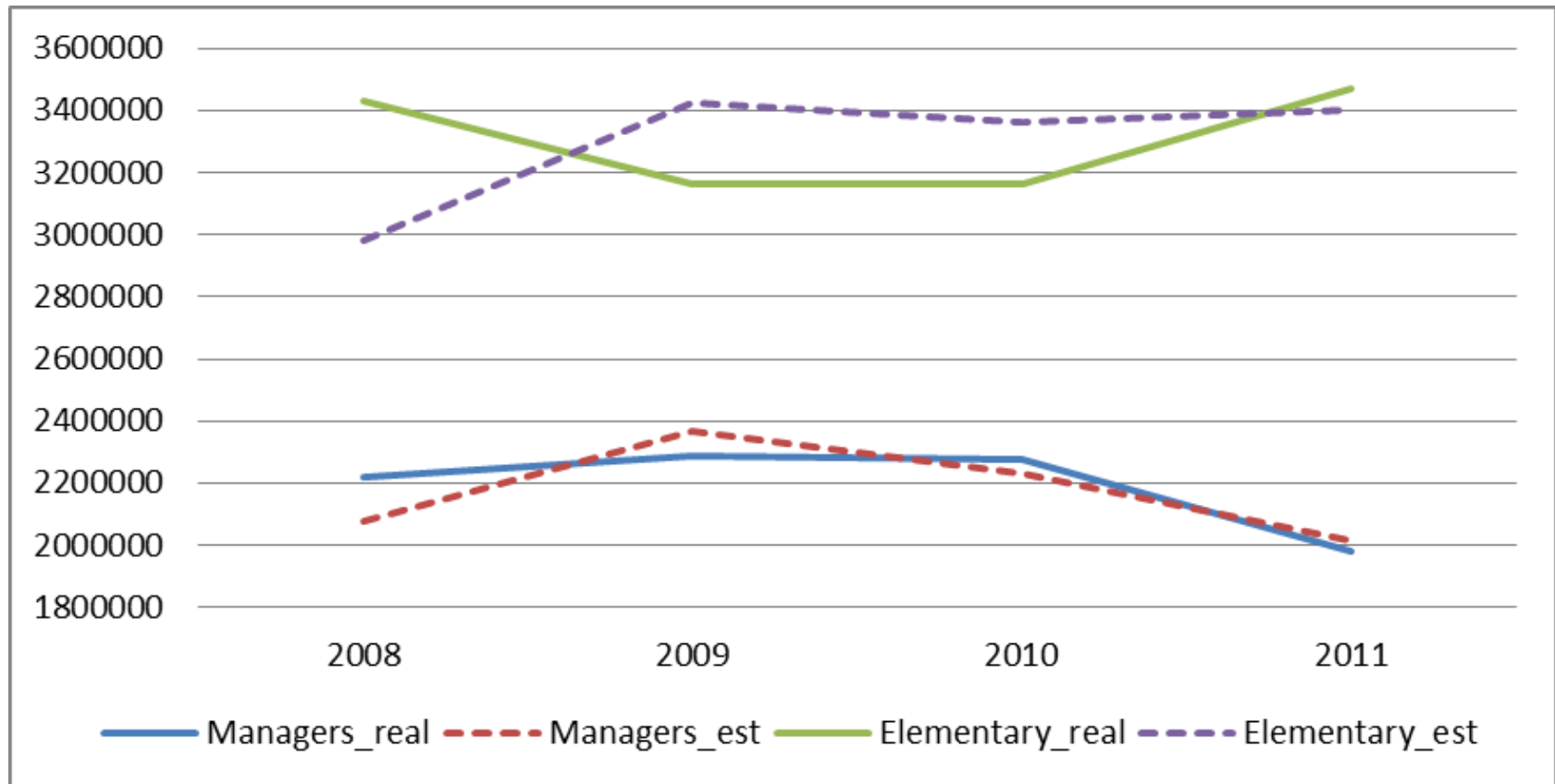
# Selected occupational results – DE

Variable	Managers		Elementary occup.	
	Coef.	Std. Err.	Coef.	Std. Err.
Female	2.199665	0.005366	3.003393	0.005342
30-44	2.195872	0.003053	1.833171	0.002874
45-59	3.267577	0.004097	3.130863	0.00396
60+	5.026653	0.016897	4.698913	0.016868
reg2	-0.68271	0.005706	-0.50515	0.00568
reg3	-0.76901	0.007585	-1.00489	0.007598
reg4	-1.41851	0.007914	-0.87825	0.007819
reg5	-2.16799	0.012008	-1.62703	0.011422
reg6	-0.06016	0.010755	-0.73121	0.010831
reg7	-0.1747	0.007394	-0.12044	0.007372
reg8	-2.24227	0.007244	-1.82966	0.007107
reg9	-1.34681	0.005833	-1.02058	0.005774
reg10	-0.51066	0.005657	-0.37032	0.005632
reg11	-1.474	0.006529	-1.15837	0.006438
reg12	-1.18398	0.013071	-0.60326	0.01274
reg13	-0.66773	0.007728	-0.10374	0.007681
reg14	-1.21475	0.008351	-0.72759	0.008226
reg15	-1.98404	0.006421	-1.86284	0.006315
reg16	-1.30842	0.008126	-0.89345	0.008064
L_EDU_M	0.818512	0.003231	-1.5686	0.003444
L_EDU_H	0.434487	0.004198	2.092765	0.003987
GS	1.33859	0.002629	1.592593	0.002599
HW	111.3879	0.247997	140.039	0.246089
UR	0.144689	0.001867	0.030258	0.001847
cons	-2.36414	0.014827	-1.93634	0.014639

# Occupational marginal effects

Variable	Managers dy/dx.	Elementary occup. dy/dx
Female	-0.04364	0.006208
30-44	0.069455	0.043254
45-59	0.070565	0.066308
60+	0.130005	0.088322
reg2	-0.00608	0.006962
reg3	0.002863	-0.01395
reg4	-0.02161	0.014256
reg5	-0.02579	0.005919
reg6	0.02451	-0.02406
reg7	0.000613	0.005074
reg8	-0.01652	0.011677
reg9	-0.0137	0.008918
reg10	-0.00706	0.002719
reg11	-0.01324	0.008554
reg12	-0.0284	0.004214
reg13	-0.01145	0.035811
reg14	-0.01471	0.021875
reg15	-0.01479	-0.0088
reg16	-0.01529	0.013985
L_EDU_M	0.03055	-0.09558
L_EDU_H	-0.01637	0.188933
GS	0.003176	0.02349
HW	1.660604	4.131156
UR	0.00648	-0.00158

# Comparison of real and estimated employment by occupation



# Conclusions

- ▶ Supply side estimation of labour market
- ▶ Demographic vs market factors (hour wages, sector growth, unemployment rate)
- ▶ DE, PL: regional variables mostly statistically non-significant

Thank you for your attention