
FDI, Innovation and within Firm Inequality: Evidence from Hungary

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 EEA ESESM

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1. Introduction
2. Related literature
3. Institutional context and Data
4. Estimation strategy
5. Results
6. Possible mechanisms

- FDI and export increase GDP at the cost of rising inequality in developing countries
 - **Main mechanism is sorting:** FDI increases wages of high-earning workers at high-paying firms

- FDI and export increase GDP at the cost of rising inequality in developing countries
 - **Main mechanism is sorting:** FDI increases wages of high-earning workers at high-paying firms
- **Limited knowledge on within firm inequality**

- Novel task-based approach to estimate inequality
 - **Abstract tasks:** done by high skilled workers, easy to outsource, hard to automatize
 - **Routine tasks:** done by low skilled workers, easy to outsource and automatize
 - **Face-to-Face tasks:** hard to outsource or automatize
- High quality Hungarian administrative linked employer-employee data: event study approach, worker and firm fixed-effects
- Investigates mechanisms

- FDI increases the return to abstract tasks only
- **Most likely mechanism:** firms innovate by getting access to the parent company's technology and introducing skilled biased technology after FDI

- Firms differ in firm specific wage premium (Abowd et al., 1999; Barth et al., 2016; Card et al., 2013; Song et al., 2019). Export (Frias et al., 2022) and FDI (Breau & Brown, 2011) increase firm premium
 - **This paper:** Technology implementation is a key mechanism
- Residual inequality increases within occupations (Lemieux, 2006) and firms (Mueller et al., 2017)
 - **This paper:** Links FDI and technology adoption to within firm inequality
- FDI (outsourcing) increases within firm inequality in developed countries (Hakkala et al., 2014, Koerner et al., 2023) because of technological change
 - **This paper:** The same mechanism is in play in developing countries as well (Vanek 1968, Acemoglu et al 2015)

- Hungary entered EU in 2004
 - Low wages compared to old EU countries
 - Fast inflow of foreign capital
 - Yearly 100-300 foreign acquisition
- Wage setting institutions are similar to Anglo-Saxon countries (Tonin, 2009)
 - Wage bargaining is on the individual level
 - Relatively easy to lay off workers
- Relatively large economic growth at the beginning and the end of observed years

- **Administrative social security data** on 50 percent of the Hungarian population between 2003 and 2017
- **Balance sheet data** from administrative tax return data
 - Detailed information on ownership
- **O*Net** occupational level task descriptions
 - **Abstract, Routine, Face-to-face** (Firpo et al., 2011)
(→ *examples*)
- **Sample restriction**
 - Full-time workers with observed occupation
 - Earnings in October
 - The employers have at least 10 employees at any observed years
 - Final sample size: 11,743,369 worker-year observations, 1,565,888 workers working at 102,183 firms

(→ *workercharacteristics*)

(→ *firmcharacteristics*)

- **Production Communautaire**
 - the production volume and unit prices for more than 4000 product categories
 - all manufacturing firms with 20+ employees and a random sample of firms below 20 employees.
- **Community Innovation Survey**
 - Firms participate with 50+ employees, every second year
 - Detailed information on past innovation activities
- **Hungarian Structure of Earnings survey**
- **Customs Statistics:**
 - universe of trading firm
 - exports and imports in 6-digit Harmonized System (HS) product breakdown for all years from 2004 to 2016.

Difference-in-differences type estimation:

$$\ln w_{ijot} = \delta_1 * Foreign_{jt} + \delta_2 * Foreign_{jt} * TaskMeasure_o + \gamma_1 * X_{ijt} + s_j + [\nu_i + f_j + f_j * t] + \epsilon_{ijt}, \quad (1)$$

- Worker FE, Firm fixed trend
- Task measure X year interactions, control for task returns at firms which are always foreign

Source of identification variation

1. Incumbent workers if the firm is acquired
2. Workers who change occupation at acquired firms
3. Workers who move from a not acquired firm to an acquired firm

VARIABLES	(1)	(2)	(3)
Foreign	0.138*** (0.030)	0.009 (0.007)	0.016** (0.007)
Fo * Abstract	0.049*** (0.011)	0.029*** (0.006)	0.012*** (0.003)
Fo * Face-to-face	-0.031*** (0.012)	-0.010 (0.007)	-0.002 (0.003)
Fo * Routine	-0.032** (0.015)	0.002 (0.009)	-0.002 (0.004)
Constant	7.803*** (0.016)	8.043*** (0.013)	9.239*** (0.009)
Obs.	11,743,369	11,743,369	11,743,369
R-squared	0.556	0.762	0.922
Year FE	YES	YES	YES
Worker charact.	YES	YES	YES
Industry FE	YES	YES	YES
Trend in return	YES	YES	YES
Firm FE		YES	YES
Firm-level trend		YES	YES
Worker FE			YES

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ Standard errors are clustered at the firm level.

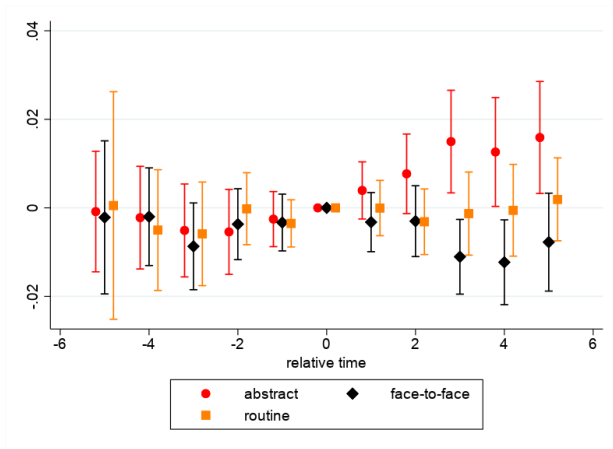


Figure: Return to tasks around the acquisition

(→ *robustness*)

Innovation: Technology import and product upgrading

1. Acquired firms do more process and product innovation without increased R&D expenditure (\rightarrow *results*)
2. Firm after foreign acquisition starts to import machines. (\rightarrow *results*)
3. The return to routine tasks decreases after a foreign acquisition from a high-income country. (\rightarrow *results*)
4. Firms start to produce more expensive products after they are acquired by foreign investors. (\rightarrow *results*)

1. Other firm-level shocks (Card et al. 2018, Lindner et al 2022)
 - The task composition does not change (\rightarrow *results*)
2. If firms grow then worker specialization increases (Becker et al. 2019)
 - The number and Herfindal index of occupations do not changes (\rightarrow *results*)
3. Efficiency wage and Monitoring
 - (\rightarrow *results*)

- The return of abstract tasks increases after FDI
 - This implies that FDI increases within-firm inequality
- We show suggestive evidence that firms innovate and implement skilled biased technology and upgrade the quality of their products

Thank you for your attention!

 Rita Pető¹ Balázs Reizer^{1,2}

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Abstract	Getting Information Processing Information Analyzing Data or Information Working with Computers Documenting/Recording Information
Face-to-face	establishing and maintaining interpersonal relation assisting and caring for others performing for or working directly with public coaching and developing others face-to-face discussion
Routine	degree of automation importance of repeating same task structured versus unstructured work pace determined by speed of equipment spend time making repetitive motion

decile	FEOR	occupation	value
Abstract			
1	2432	Early childhood educator	-1.37
2	8190	Other manufacturing machine operator	-.27
3	1333	Sales and marketing manager	.78
4	2123	Telecommunications engineer	1.57
Face-to-face			
1	2122	Electrical engineer (electronics engineer)	-1.19
2	3163	Working and operating safety specialist	-.16
3	5241	Cleaning supervisor	.74
4	1416	Advertising and PR manager	1.98
Routine			
1	3514	Signing interpreter	-1.86
2	5133	Bartender	-.88
3	3112	Metallurgical and materials technician	-.03
4	3153	Chemical processing plant controller	1.17

	Abstract	face-to-face
face-to-face	0.43***	
Routine	-0.46***	-0.49***

	Domestic	Pre-Acq.	Post-Acq.	Always Foreign
Male (%)	63.7	64.0	62.8	56.7
Age	40.9 (10.9)	39.1 (10.8)	40.5 (10.9)	38.3 (10.4)
Abstract	-0.12 (1.00)	-0.05 (1.02)	0.05 (1.00)	0.18 (0.98)
Face-to-face	0.09 (0.98)	-0.04 (0.96)	-0.00 (0.97)	-0.14 (1.01)
Routine	-0.01 (0.94)	-0.02 (0.98)	0.01 (1.02)	0.01 (1.09)
Observation	6,806,681	233,494	451,747	4,251,447

(→ back)

	Domestic	Pre-Acq.	Post-Acq.	Always Foreign
Employment	24.2 (200.2)	39.2 (114.8)	54.2 (224.0)	108.9 (468.3)
Log Sales	11.93 (1.47)	12.68 (1.76)	12.97 (1.74)	13.55 (2.03)
Manuf. (%)	38.9	30.5	28.3	38.0
Service (%)	61.1	69.5	71.7	62.0
Observation	673,548	13,685	19,142	88,349

(→ *back*)

(→ *link*)

- subsample of acquired firms (→ *link*)
 - the results are not driven by managers (→ *link*)
 - the results are valid for incumbent workers (→ *link*)
 - the results are not driven by small firms (→ *link*)
- the results are robust to controlling for time-varying firm-level controls and county-year fixed effects (→ *link*)
- the results are not driven by the pattern that firms start to export after a takeover (→ *link*)
- the results are valid for the service and the manufacturing sector as well (→ *link*)
- the results are robust to use an alternative way of measuring task usage (→ *link*)

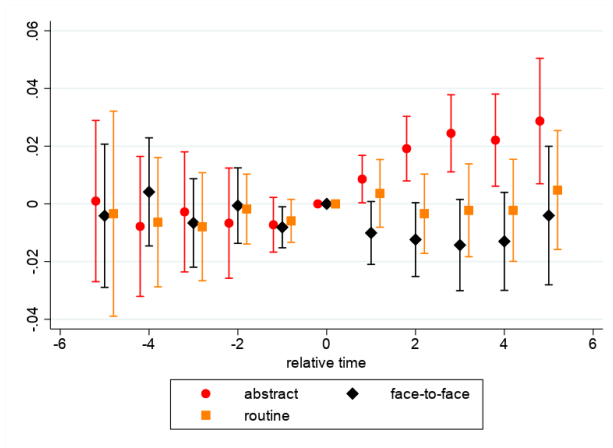


Figure: Return to tasks around the acquisition

(→ back)

VARIABLES	(1)	se	(2)	se
	coef		coef	
Foreign	0.143***	(0.030)	0.027***	(0.010)
Foreign * Abstract	0.046***	(0.013)	0.025***	(0.006)
Foreign * Face-to-face	-0.030*	(0.016)	-0.017***	(0.006)
Foreign * Routine	-0.025	(0.016)	0.003	(0.008)
Constant	7.941***	(0.059)	8.091***	(0.025)
Observations	634,441		634,441	
R-squared	0.436		0.719	
Worker Charact.	YES		YES	
Industry	YES		YES	
Year	YES		YES	
trend in task return	YES		YES	
Firm FE			YES	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (\rightarrow back)

VARIABLES	(1)	se	(2)	se
	coef		coef	
Foreign	0.159***	(0.037)	0.035***	(0.011)
Foreign * Abstract	0.050***	(0.012)	0.024***	(0.007)
Foreign * Face-to-face	-0.007	(0.014)	-0.001	(0.007)
Foreign * Routine	-0.008	(0.018)	0.007	(0.009)
Constant	7.984***	(0.090)	8.186***	(0.055)
Observations	221,545		221,545	
R-squared	0.421		0.694	
Worker Charact.	YES		YES	
Industry	YES		YES	
Year	YES		YES	
trend in task return	YES		YES	
Firm FE			YES	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (\rightarrow back)

VARIABLES	(1)	se	(2)	se
	coef		coef	
Foreign	0.131***	(0.037)	0.028**	(0.013)
Foreign * Abstract	0.038**	(0.016)	0.031***	(0.008)
Foreign * Face-to-face	-0.010	(0.015)	-0.006	(0.009)
Foreign * Routine	-0.010	(0.018)	0.015	(0.011)
Constant	7.962***	(0.074)	8.114***	(0.038)
Observations	504,527		504,527	
R-squared	0.473		0.676	
Worker Charact.	YES		YES	
Industry	YES		YES	
Year	YES		YES	
trend in task return	YES		YES	
Firm FE			YES	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (\rightarrow back)

VARIABLES	coef	se	coef	se	coef	se
Foreign	0.094***	(0.019)	0.010	(0.007)	0.015**	(0.006)
Fo * Abstract	0.039***	(0.010)	0.029***	(0.007)	0.012***	(0.003)
Fo * Face-to-face	-0.026***	(0.010)	-0.009	(0.007)	-0.002	(0.003)
Fo * Routine	-0.028**	(0.012)	0.002	(0.009)	-0.002	(0.004)
Constant	7.434***	(0.032)	8.028***	(0.015)	9.157***	(0.014)
Obs	11,694,471		11,694,471		11,694,471	
R-squared	0.585		0.764		0.922	
Year FE	YES		YES		YES	
Worker charact.	YES		YES		YES	
Industry FE	YES		YES		YES	
trend in task	YES		YES		YES	
Firm FE			YES		YES	
Firm-level trend			YES		YES	
Worker FE					YES	
Firm Charact.	YES		YES		YES	
County-year FE	YES		YES		YES	

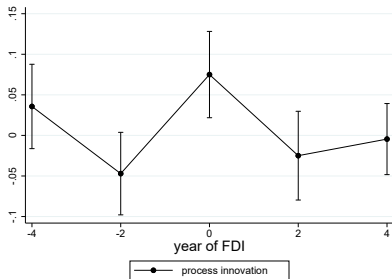
VARIABLES	coef	se	coef	se	coef	se
Foreign	0.124***	(0.029)	0.010	(0.007)	0.016**	(0.007)
Fo * Abstract	0.044***	(0.011)	0.028***	(0.006)	0.012***	(0.003)
Fo * Face-to-face	-0.029**	(0.012)	-0.010	(0.007)	-0.002	(0.003)
Fo * Routine	-0.029**	(0.014)	0.003	(0.009)	-0.001	(0.004)
Exporting	0.131***	(0.009)	-0.003	(0.002)	-0.001	(0.002)
Exp * Abstract	0.024***	(0.005)	0.013**	(0.006)	-0.001	(0.001)
Exp * Face-to-face	-0.022***	(0.006)	0.001	(0.006)	-0.001	(0.001)
Exp * Routine	-0.024***	(0.006)	-0.010***	(0.003)	-0.003***	(0.001)
Constant	7.750***	(0.016)	8.045***	(0.013)	9.240***	(0.009)
Obs	11,743,369		11,743,369		11,743,369	
R-squared	0.563		0.762		0.922	
Worker charact.	YES		YES		YES	
Industry-year FE	YES		YES		YES	
trend in task	YES		YES		YES	
Firm FE			YES		YES	
Firm-level trend			YES		YES	
Worker FE					YES	

VARIABLES	coef	se	coef	se	coef	se
Foreign	0.147***	(0.053)	0.012	(0.009)	0.017	(0.012)
Fo * Service	-0.013	(0.057)	-0.005	(0.013)	-0.001	(0.014)
Fo * Abstract	0.045***	(0.015)	0.036***	(0.008)	0.010**	(0.004)
Fo * Abst. * Service	0.004	(0.022)	-0.010	(0.012)	0.003	(0.006)
Fo * Face-to-face	-0.011	(0.013)	-0.011	(0.009)	0.002	(0.005)
Fo * F2F * Service	-0.025	(0.019)	0.004	(0.014)	-0.006	(0.006)
Fo * Routine	-0.005	(0.017)	0.009	(0.013)	-0.001	(0.004)
Fo * Rout. * Service	-0.049**	(0.024)	-0.014	(0.018)	-0.001	(0.007)
Constant	7.806***	(0.018)	8.042***	(0.013)	9.237***	(0.009)
Obs	11,743,369		11,743,369		11,743,369	
R-squared	0.557		0.763		0.922	
Year FE	YES		YES		YES	
Worker charact.	YES		YES		YES	
Industry FE	YES		YES		YES	
trend in task	YES		YES		YES	
Firm FE			YES		YES	
Firm-level trend			YES		YES	
Worker FE					YES	

VARIABLES	coef	se	coef	se	coef	se
Foreign	0.143***	(0.030)	0.010	(0.007)	0.016**	(0.007)
Fo * Abstract	0.056***	(0.013)	0.027***	(0.007)	0.011***	(0.003)
Fo * Face-to-face	-0.021*	(0.011)	-0.007	(0.006)	0.001	(0.003)
Fo * Routine	-0.026*	(0.014)	-0.003	(0.007)	-0.001	(0.003)
Constant	7.802***	(0.017)	8.040***	(0.013)	9.243***	(0.009)
Obs	11,744,867		11,744,867		11,744,867	
R-squared	0.549		0.757		0.922	
Year FE	YES		YES		YES	
Worker charact.	YES		YES		YES	
Industry FE	YES		YES		YES	
trend in task	YES		YES		YES	
Firm FE			YES		YES	
Firm-level trend			YES		YES	
Worker FE					YES	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ (\rightarrow back)

Figure: Process innovation



(→ back)

Figure: Product innovation

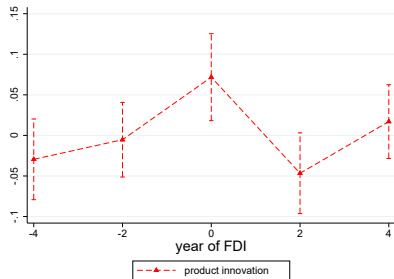


Figure: Organizational innovation

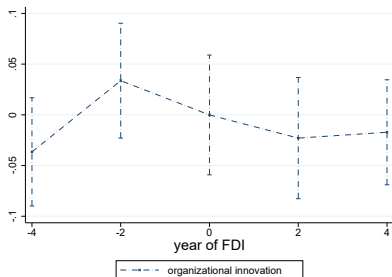


Figure: R&D activity

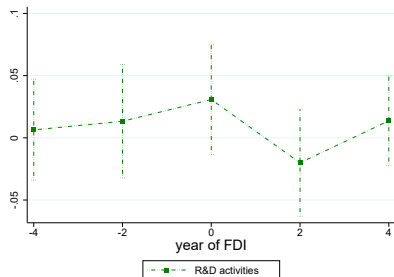
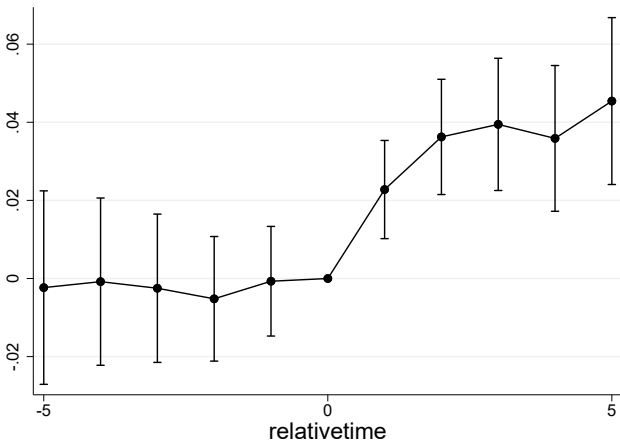


Figure: Probability of importing Capital goods



(3) The return to routine task decreases

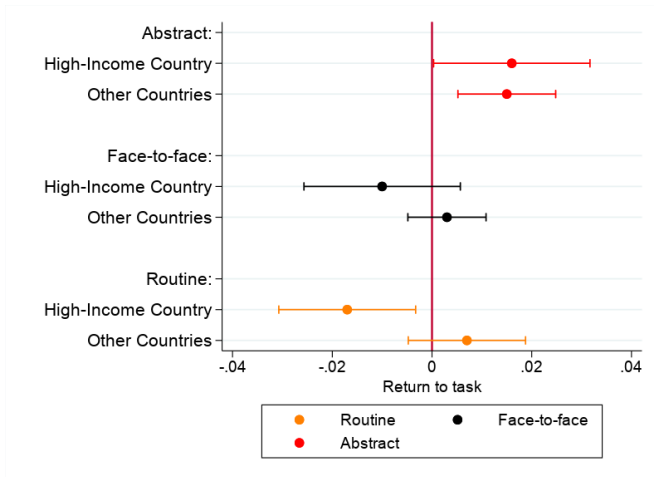


Figure: The effect of FDI by the income of the source country

VARIABLES	Total price	Contribution of		
		country	variety	quality
Foreign	0.106** (0.045)	0.001 (0.002)	0.054* (0.030)	0.051** (0.025)
Constant	4.609*** (0.029)	-0.001 (0.001)	-0.054*** (0.019)	-0.032** (0.016)
Firm FE	Yes	Yes	Yes	Yes
Observations	114,643	114,628	114,628	114,628
R-squared	0.980	0.874	0.988	0.631

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ Standard errors are clustered at the firm level.

Table: The effect of foreign acquisition on product quality

(→ back)

- Demand shocks or Hicks-neutral productivity shocks do not change the relative demand curve, but firms chose a different point (Card et al 2018) -> return \uparrow , demand \downarrow
- Skill-biased technology shock change the relative demand curve -> return and demand can \uparrow at the same time (Lindner et al 2022)

Firm level task use is the share of task n in total task use:

$$Taskuse_{njt} = \frac{\sum_i TaskMeasure_{nijt}}{\sum_{n=1}^3 \sum_i TaskMeasure_{nijt}}, \quad (2)$$

(\rightarrow back)

VARIABLES	(1) coef	se	(2) coef	se	(3) coef	se
Panel A: Abstract tasks						
Foreign	0.003**	(0.002)	-0.000	(0.000)	0.000	(0.000)
Constant	0.324***	(0.000)	0.329***	(0.000)	0.358***	(0.002)
R-sq	0.361		0.941		0.943	
Panel B: Face-to-face						
Foreign	-0.001	(0.001)	0.001*	(0.000)	0.001*	(0.000)
Constant	0.344***	(0.000)	0.342***	(0.000)	0.345***	(0.001)
R-sq	0.427		0.938		0.938	
Panel C: Routine						
Foreign	-0.002	(0.002)	-0.000	(0.000)	-0.001*	(0.000)
Constant	0.332***	(0.000)	0.329***	(0.000)	0.296***	(0.002)
R-sq	0.384		0.934		0.936	
Obs	778,441		778,441		778,441	
Year	Yes		Yes		Yes	
Industry	Yes		Yes		Yes	
Firm FE			Yes		Yes	
Firm trend			Yes		Yes	
Firm cont.					Yes	

- If firm size grows, workers specialize in specific tasks (Becker et al 2019)
 - Number of occupations increases
 - Within firm inequality \uparrow within occupation inequality \downarrow
- **In our case:** Some workers may do more abstract tasks without changing occupations

(\rightarrow *back*)

VARIABLES	coef	se	coef	se	coef	se
Panel A: Number of occupations						
Foreign	11.608*	(6.594)	1.184	(1.010)	0.858	(0.946)
Constant	12.301***	(0.508)	25.405***	(0.152)	-7.663***	(2.508)
R-sq	0.373		0.986		0.987	
Panel B: Herfindhal index						
Foreign	-0.035*	(0.020)	-0.001	(0.004)	0.002	(0.004)
Constant	0.402***	(0.003)	0.326***	(0.001)	0.567***	(0.018)
R-sq	0.141		0.891		0.892	
No obs.	778,441		778,441		778,441	
Year	Yes		Yes		Yes	
Industry	Yes		Yes		Yes	
Firm FE			Yes		Yes	
Firm trend			Yes		Yes	
Firm cont					Yes	

(→ *back*)

- Monitoring repetitive tasks and measuring their output is easier than that of abstract tasks - results in different compensating share by tasks
- Monitoring from a distance is less efficient.
- The two can interact and lead our main results.

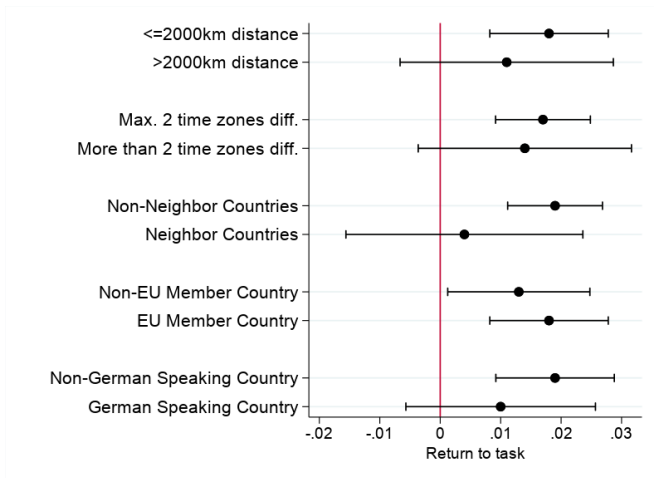


Figure: Heterogeneity and the return to abstract tasks

Figure: Face-to-face tasks

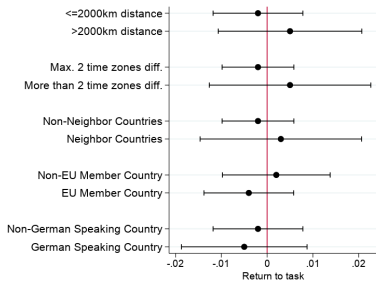
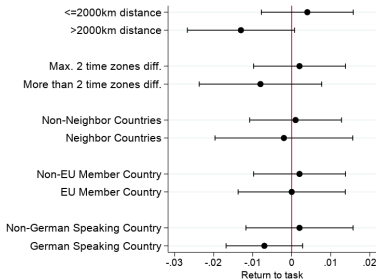


Figure: Routine



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