

FIS Junior Research Group
Green Transition,
Labour Markets, Vocational and Further Training



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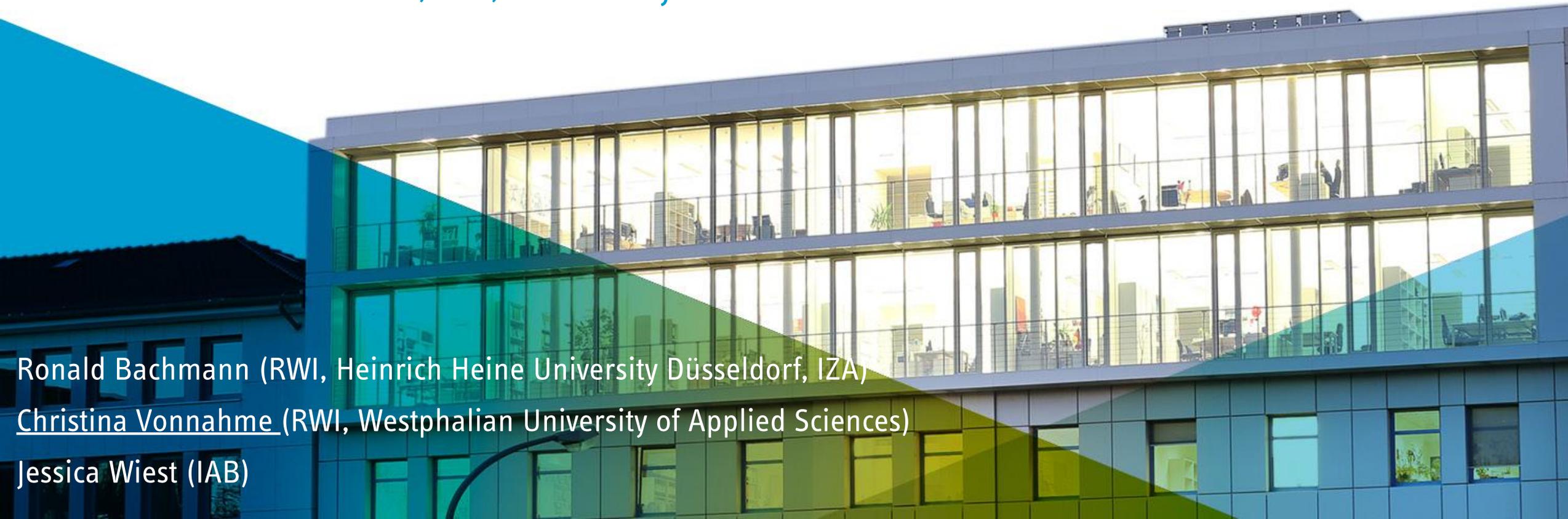


Leibniz Institute for
Economic Research

Wages in the Green Transition

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MOTIVATION & RELEVANCE

- Climate crisis and other environmental crises drive need for **green transition**
 - Climate/environmental policies affect supply
 - e.g. regulations such as EU-ETS, carbon taxes
 - Firms see need for change
 - Changes in consumer behaviour (demand)
- } → production processes and outputs change

Labour-market adjustments

- Demand & supply for specific skills/occupations is expected to change
- Limited evidence on implications for wages, especially for Germany
- Wages are crucial in the green transition:
 - Potential wage/welfare losses or gains → just transition?
 - Incentives for workers to switch to greener occupations, speeding up/slowing down the green transition

RESEARCH QUESTIONS

1. How strongly **do wages differ between occupations** featuring different levels of greenness, and in particular: is there a **green wage premium** in Germany? To what extent can wage differences between occupations with different levels of greenness be **explained by observable characteristics** of workers, firms and occupations?
2. How have workers' **wages evolved** during the green transition, and which factors can explain this evolution?

RELATED LITERATURE

- Evidence for a **green wage premium**:
 - ~ 4 % higher wages for green-skill occupations vs. non-green within 3-digit SOC (Vona et al. 2019; US data, 2006–2014)
 - ~ 7 % earnings premium for average green-intensive vs. average pollution-intensive occupation (Bluedorn et al. 2023; cross-country sample for 31 countries, 2005–2019)
 - Between 2% and 16 % premium for low-carbon vs. non-low-carbon jobs within some occupational groups (Saussay et al. 2022/2025; US data on online job postings, 2010–2019)
- However, evidence that premia **decline over time** and **differ strongly** between occupations (Saussay et al. 2022, Vona et al. 2019)
- **Some pollution-intensive jobs are high-paying** → large wage losses after displacements (Barreto et al. 2023)

OUR CONTRIBUTIONS

- Evidence for **Germany**, large economy with high manufacturing share
- **Country-specific, annually updated task-based measure** of occupational greenness (in a broad sense: > climate)
- **Entire labour market** considered instead of specific industries (but: only full-time workers)
- **Data very granular**
 - Occupational classification provides 144 3-digit occupations (~50% more than O*NET) and ~1.300 5-digit occupations
 - Data cover universe of German (full-time) workers in dependent employment
- Analyse several sets of factors contributing to wage differences

DATA

Administrative worker-level panel data for 2012–2022

- IAB Employment History (BeH): all employees liable to social security
- Focus on full-time workers in regular employment aged 16–65

Greenness-of-Jobs Index (GOJI) for 2012–2022

- Measure of greenness of occupations in Germany by Janser (2019, 2025)
- Based on the occupational tasks from BERUFENET

$$GOJI_{occ,t} = \frac{\sum green\ tasks_{occ,t} - \sum brown\ tasks_{occ,t}}{\sum tasks_{occ,t}}$$

- Divide occupations in 5 GOJI groups: [-1;-0.1] [-0.1;0] [0] (0;0.1] (0.1;1]

Wage
description

Sample
description

DATA & METHODS: TASK APPROACH

BERUFENET

- Expert database provided by the German Federal Employment Agency (**annually updated**)
- Descriptions of about 4,400 occupations (8-digit level) with
- Tasks typically performed (overall about 7,700 tasks, Ø 21 tasks per occupation)

Green/White/Brown Tasks (Janser 2019, 2025)

- Differentiate between green, white, and brown tasks (potentially beneficial/neutral/harmful to the environment or climate)
- Identified via Natural Language Processing based on keyword lists and editorial processes

Example **green task**:

*energy-efficient building
insulation, installation of heat
pumps*

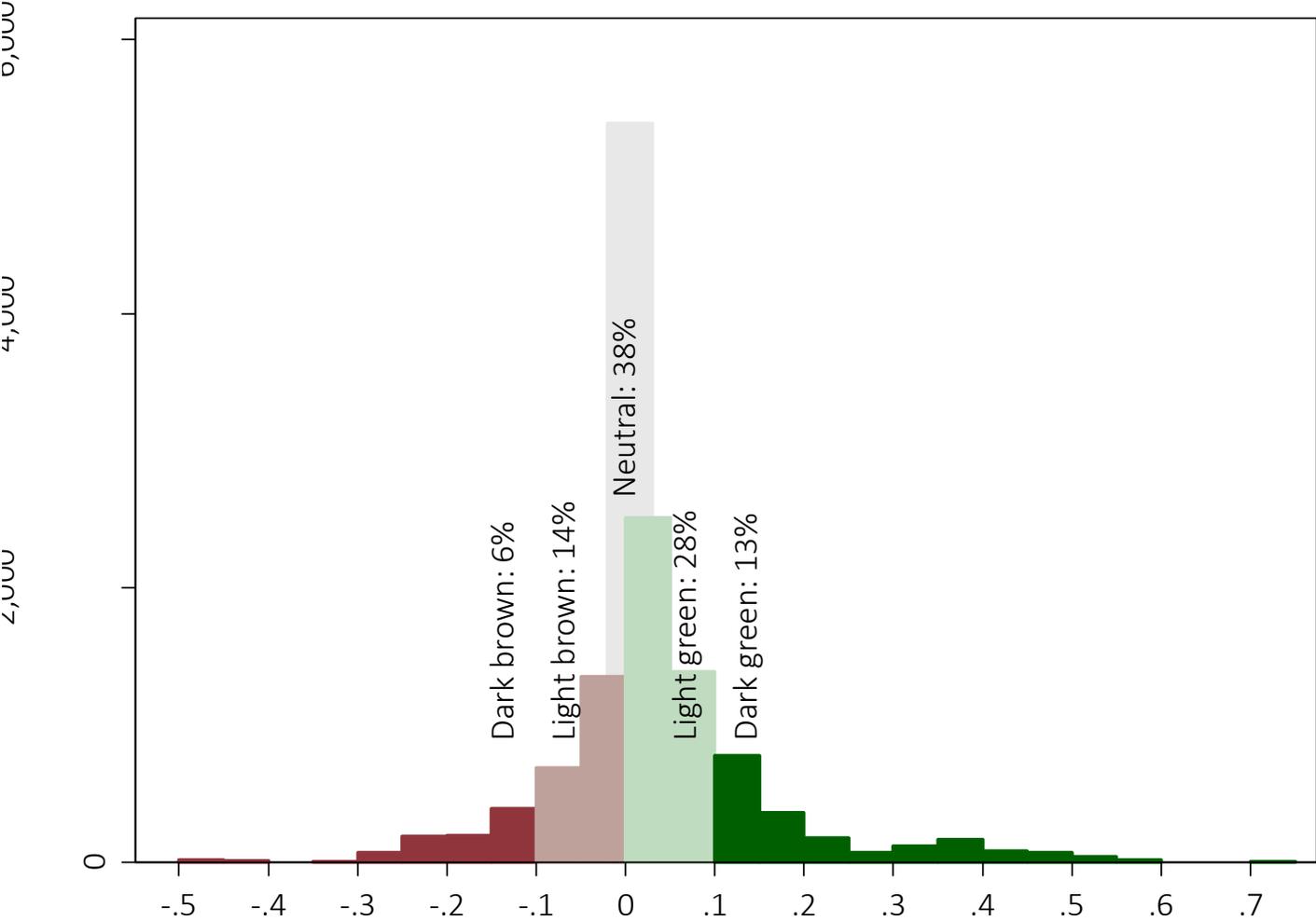
Example **white task**:

teaching, nursing

Example **brown task**:

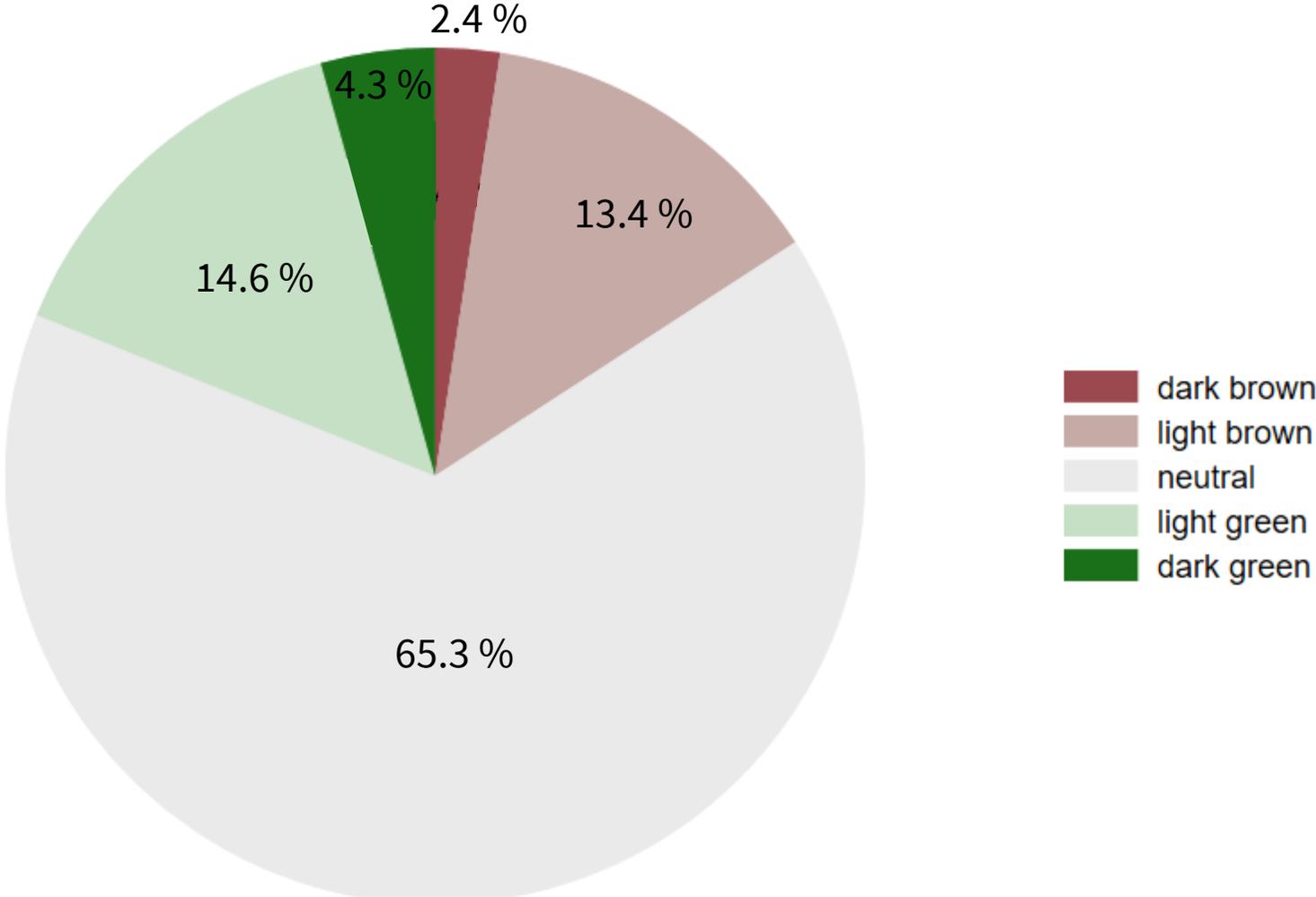
coal refining, concreting

DISTRIBUTION OF GOJI AT THE OCCUPATIONAL LEVEL (2012–22)

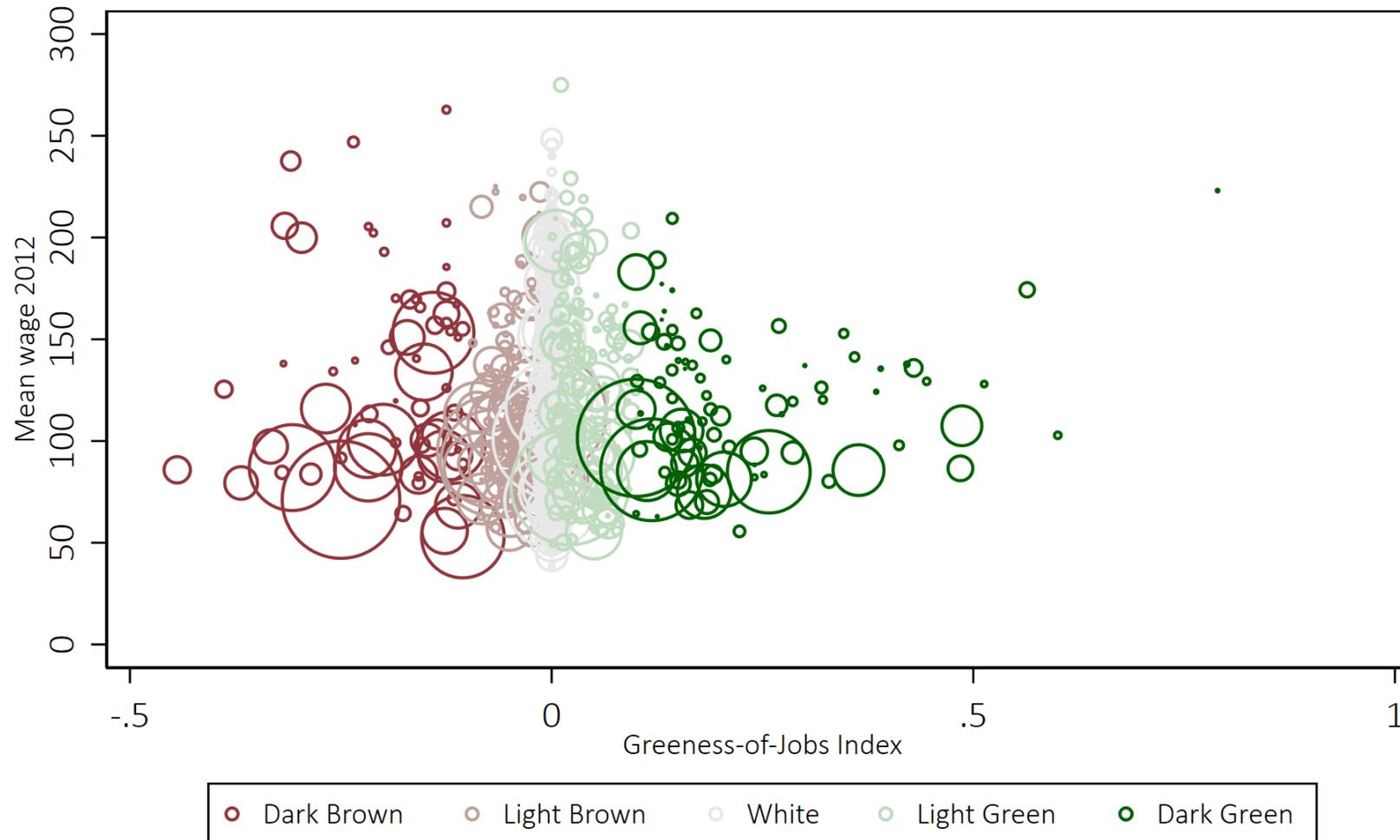


Mean: 0.024
Median: 0.000
SD: 0.107
Min: -.474
Max: .737
Obs: 14,105

EMPLOYMENT SHARES BY GOJI GROUP (2012)

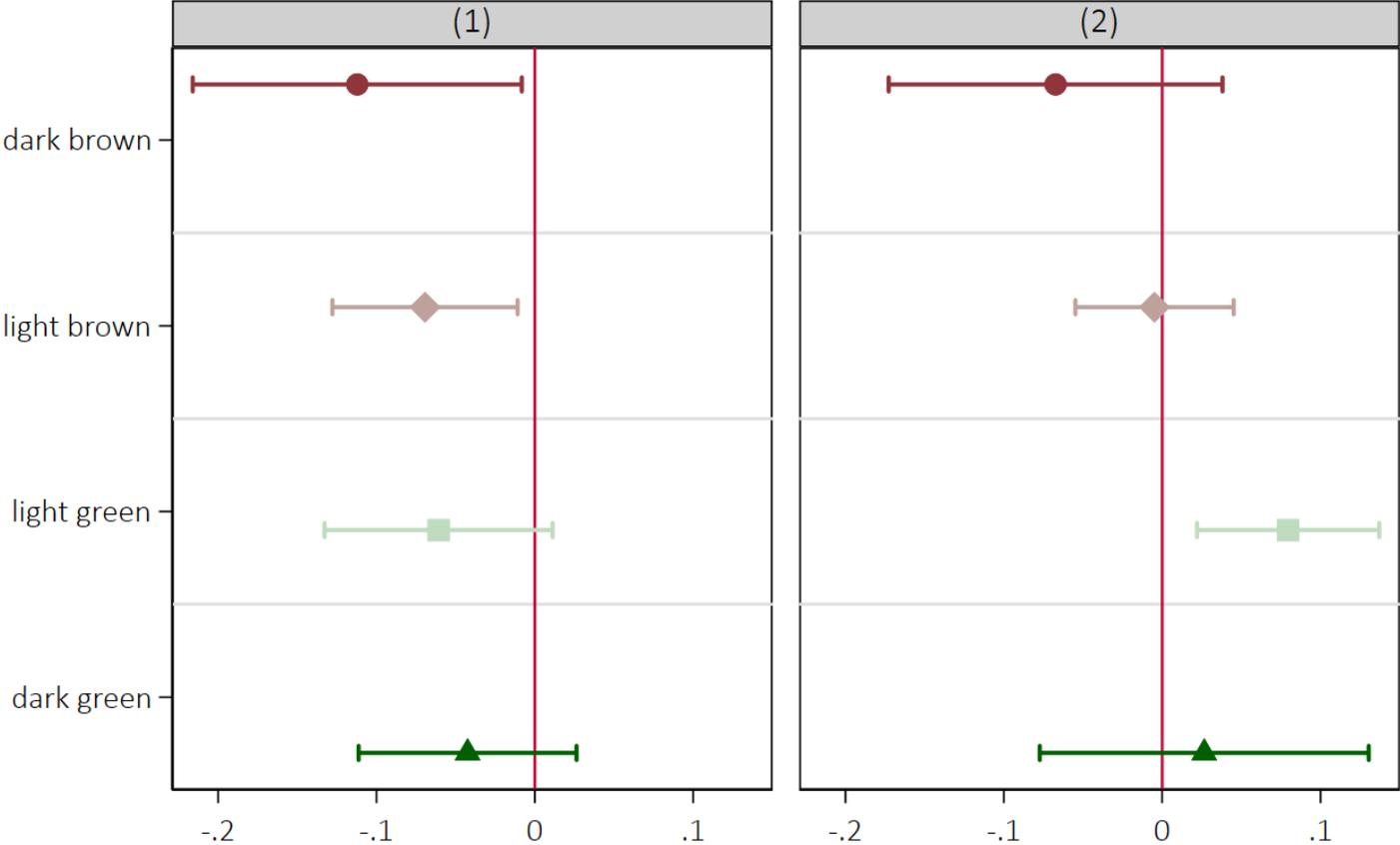


MEAN DAILY WAGES AT THE OCCUPATIONAL LEVEL (2012)



WAGE DIFFERENCES (2012)

Regression: log daily wage on GOJI group dummies – without/with 3-digit occupation FE



Notes: (1) includes individual and establishment control variables, (2) includes individual, establishment and 3-digit occupation control variables. SEs clustered at the occupational level. Markers show point estimates, lines 95% CIs. Sources: BeH, BERUFENET, 2012, own calculations

WAGE CHANGE FOR INITIAL GOJI GROUPS

	Change in log real wages between year t and year t + τ :			
	(1) t + 1	(2) t + 2	(3) t + 5	(4) t + 10
Dark brown	-0.006*** (0.000)	-0.010*** (0.000)	-0.017*** (0.000)	-0.027*** (0.001)
Light brown	-0.006*** (0.001)	-0.011*** (0.002)	-0.022*** (0.003)	-0.041*** (0.000)
Light green	-0.002*** (0.000)	-0.003*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Dark green	-0.004*** (0.000)	-0.007*** (0.000)	-0.012*** (0.000)	-0.023*** (0.000)
Constant	0.023*** (0.000)	0.046*** (0.000)	0.110*** (0.000)	0.098*** (0.000)
Observations	174,498,710	147,772,981	84,905,326	11,154,683
Individuals	27,876,594	25,373,483	19,808,394	11,154,683

SE in parentheses, clustered at individual level. All regressions include year dummies. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Sources: BeH, BERUFENET, 2012–2022, own calculations.

CAN WORKERS AVOID WAGE PENALTIES?

WAGE CHANGE FOR LIGHT BROWN GOJI GROUP WORKERS

From light brown	Change in log real wages between year t and year t + τ :			
	(1) t + 1	(2) t + 2	(3) t + 5	(4) t + 10
To dark brown	-0.001 (0.001)	-0.008*** (0.001)	-0.012*** (0.001)	-0.024*** (0.004)
To white	-0.001* (0.000)	0.010*** (0.001)	0.018*** (0.001)	0.026*** (0.002)
To light green	-0.007*** (0.001)	-0.006*** (0.001)	0.001 (0.001)	0.025*** (0.003)
To dark green	-0.000 (0.001)	0.005*** (0.001)	0.006*** (0.001)	-0.003 (0.004)
Occupation change between t and t + 1	0.027*** (0.000)	0.037*** (0.000)	0.047*** (0.001)	0.051*** (0.002)
Job change between t and t + 1	0.021*** (0.000)	0.033*** (0.000)	0.044*** (0.000)	0.061*** (0.001)
Constant	0.012*** (0.000)	0.030*** (0.000)	0.078*** (0.000)	0.042*** (0.000)
Observations	22,555,443	18,906,584	11,280,874	1,568,428
Individuals	4,235,282	3,735,006	2,900,697	1,568,428

SE in parentheses, clustered at individual level. All regressions include year dummies. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

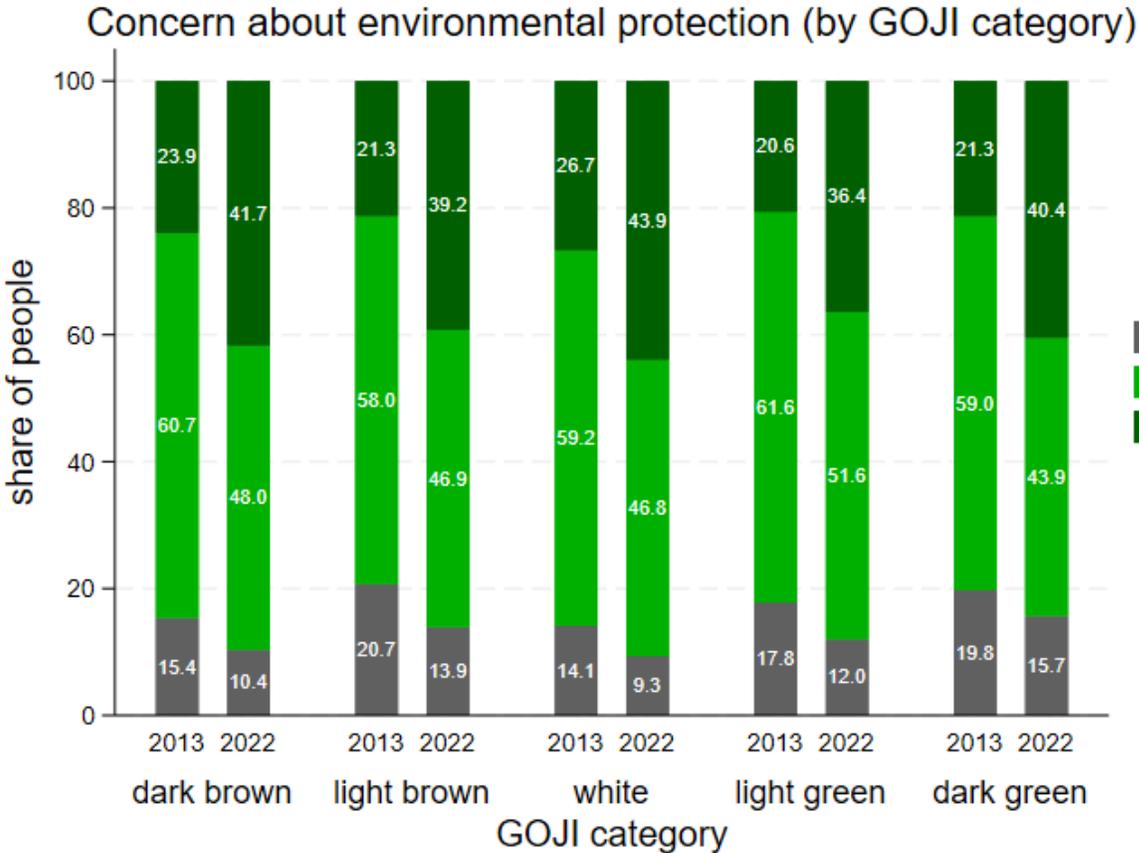
Sources: BeH, BERUFENET, 2012–2022, own calculations.

COMPENSATING WAGE DIFFERENTIALS AS ALTERNATIVE EXPLANATION?

- **Intrinsic motivation** to work in green occupations could lead to **selection of workers** into these occupations and therefore lower wages.
 - This could **potentially explain the overall absence of a green wage premium**
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- Analyse the relationship between being concerned about climate/environment and being employed in a certain GOJI group
 - Use **survey data** from German Socio-Economic panel

CONCERN ABOUT THE ENVIRONMENT

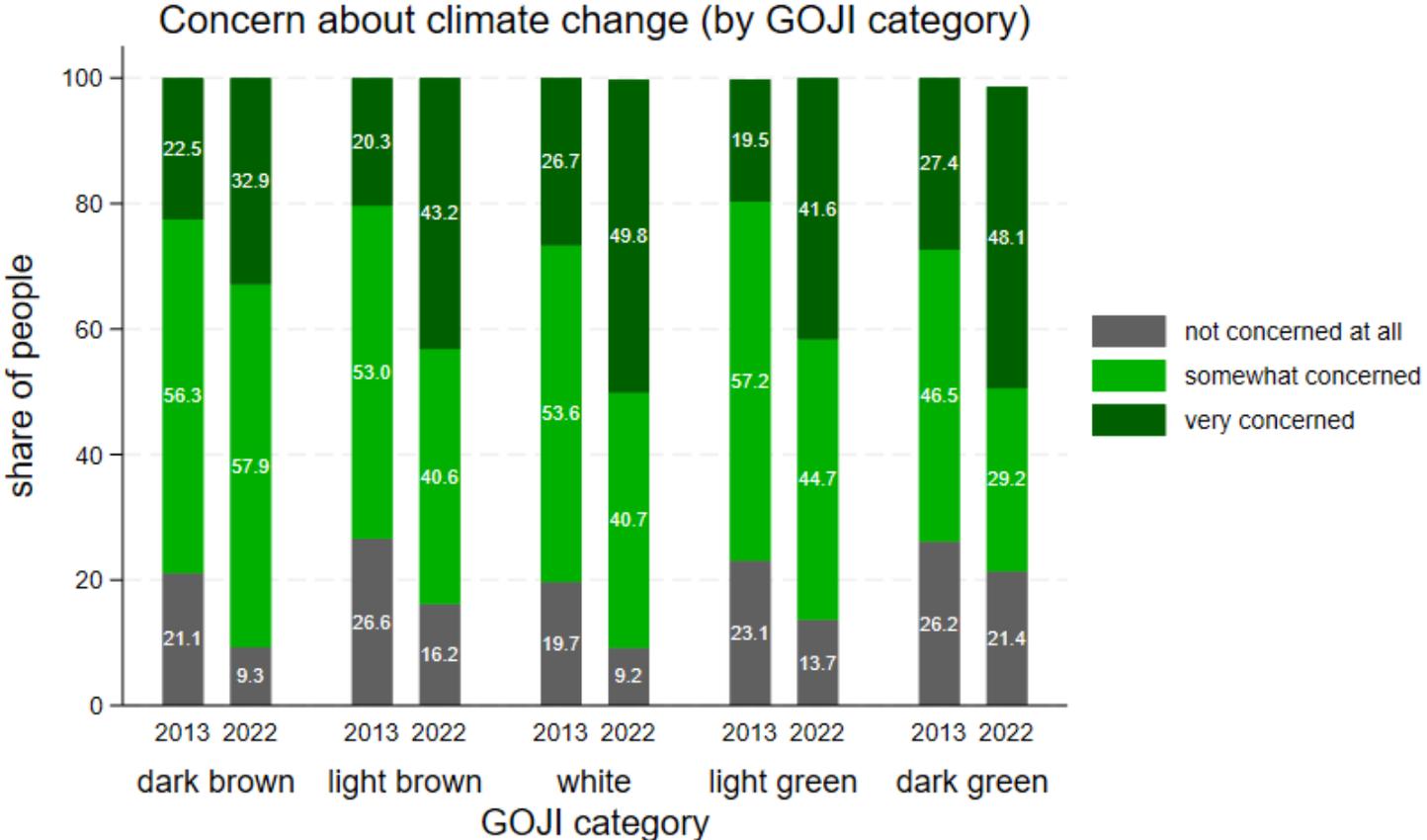
Question: How concerned are you about the following issues? (Environmental protection)



➤ Concern is similar across all GOJI groups

CONCERN ABOUT CLIMATE CHANGE

Question: How concerned are you about the following issues? (The impacts of climate change)



➤ Concern is considerably smaller in dark brown GOJI group

REGRESSION

DV: Dummy variable “very concerned about **the environment**” (2013)

	(1)	(2)	(3)	(4)
[1] Dark brown	-0.025 (0.077)	-0.007 (0.077)	-0.011 (0.078)	0.003 (0.081)
[2] Light brown	-0.054*** (0.020)	-0.037* (0.020)	-0.038* (0.020)	-0.027 (0.023)
[4] Light green	-0.061*** (0.018)	-0.048** (0.019)	-0.048** (0.019)	-0.040* (0.021)
[5] Dark green	-0.055 (0.041)	-0.036 (0.041)	-0.029 (0.041)	-0.021 (0.042)
Controls	None	Individual char.	+ Establishment char. (incl. federal state FE)	+ Task composition measure
Observations	5,820	5,820	5,785	5,778
Adjusted R ²	0.004	0.006	0.009	0.009

➤ Concern tends to be smaller in brown and green GOJI groups

Standard errors in parentheses
* p < 0.10 ** p < 0.05 *** p < 0.01

REGRESSION

DV: Dummy variable “very concerned about **climate change**” (2013)

	(1)	(2)	(3)	(4)
[1] Dark brown	-0.039 (0.075)	-0.016 (0.074)	-0.032 (0.078)	-0.016 (0.078)
[2] Light brown	-0.063 ^{***} (0.021)	-0.042 ^{**} (0.021)	-0.039 [*] (0.021)	-0.028 (0.023)
[4] Light green	-0.072 ^{***} (0.021)	-0.056 ^{***} (0.021)	-0.057 ^{***} (0.021)	-0.049 ^{**} (0.023)
[5] Dark green	0.007 (0.049)	0.032 (0.047)	0.039 (0.046)	0.050 (0.046)
Controls	None	Individual char.	+ Establishment char. (incl. federal state FE)	+ Task composition measure
Observations	5,817	5,817	5,782	5,775
Adjusted R ²	0.006	0.011	0.019	0.019

➤ Concern tends to be smaller in brown and **light** green GOJI groups

Standard errors in parentheses
* p < 0.10 ** p < 0.05 *** p < 0.01

CONCLUSION

- RQ1: Green wage premium?
 - **Overall (without occ. FE) no evidence of a green wage premium** in Germany: relatively low wages in brown- and green-task occupations, highest wages in white-task occupations
 - Within 3-digit occupations: evidence for wage premium within light green occupations
 - **Some incentives** to move to occupations with more green tasks
- RQ2: **Evolution over time**
Can job and occupational mobility improve workers' wage growth?
 - **Lowest growth** for workers starting in **light brown**
 - Job and occupational switches **mitigates these penalties**, particularly when moving to white or light green occupations
- **Selection of workers** into green occupations **unlikely to explain** absence of green wage premium.