

# Remote Work and Inequality

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ESCoE

# Motivation

Working from home has entrenched inequality - how can we use it to improve lives instead?

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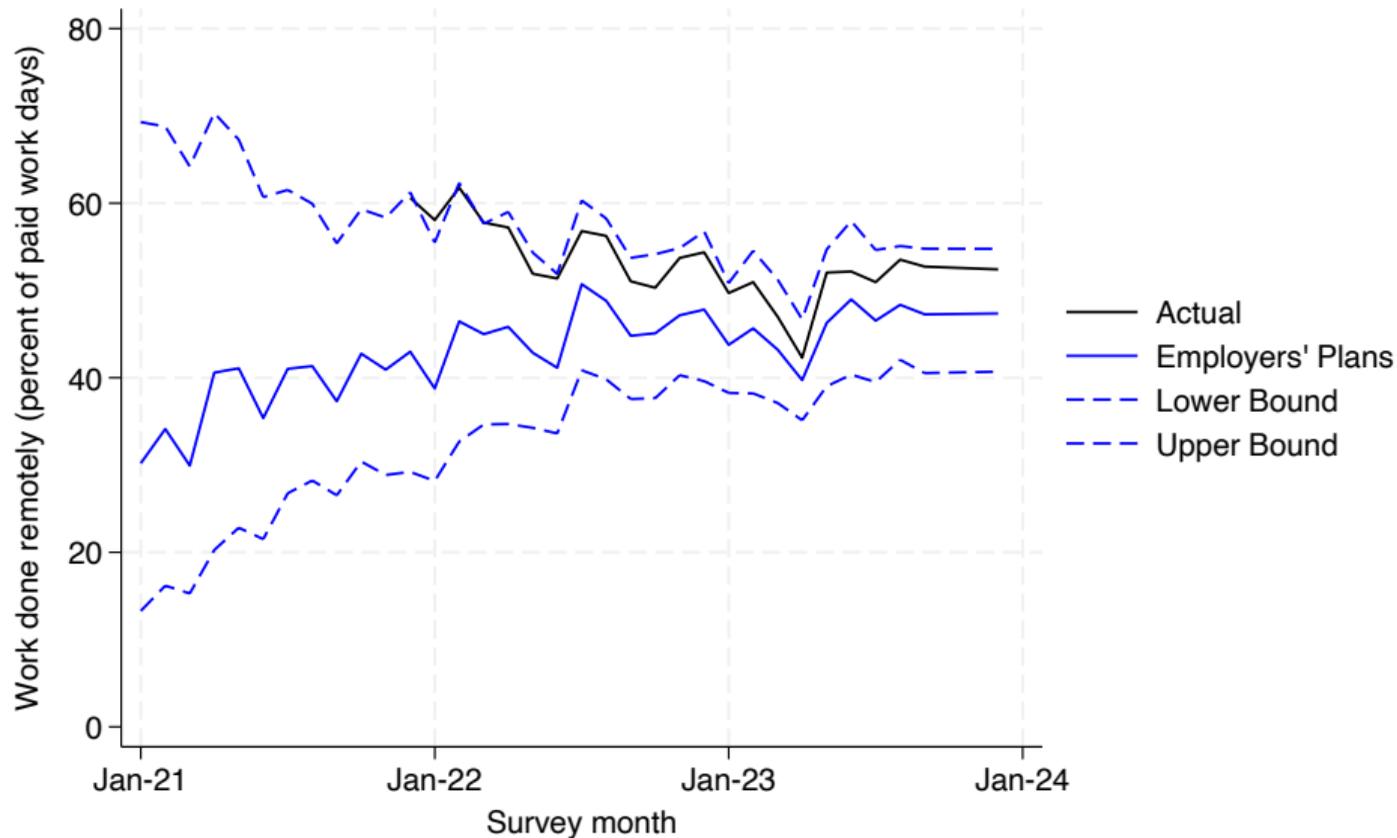
Many people face longer hours and constant surveillance. But more flexibility could bring long-term benefits



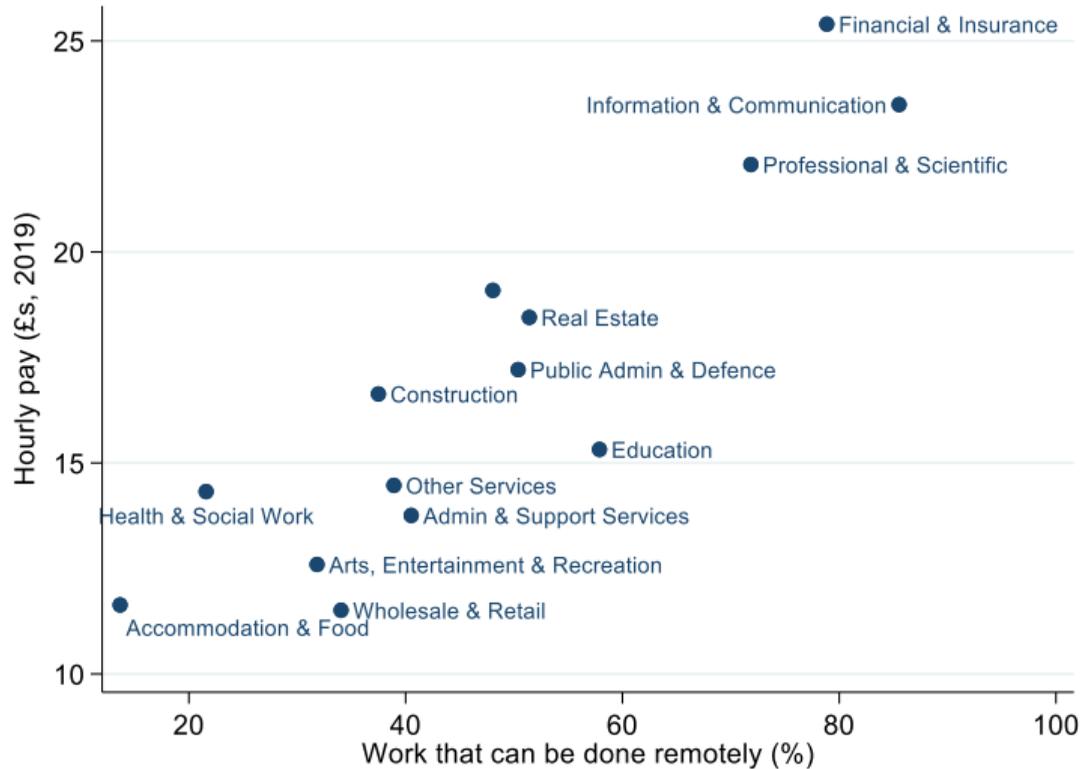
# Motivation

- Since the pandemic working from home (WFH) has increased substantially (Barrero et al, 2021; Hansen et al 2023).
- The post-pandemic rise in WFH has led to a spatial shift in economic activity.
  - Where work is done (Althoff et al., 2022; De Fraja et al., 2021; Barrero et al., 2021).
  - Local service spending (De Fraja et al., 2022; Barrero et al., 2021, Alipour et al., 2022).
  - Real estate demand (Gupta et al., 2022; Gokan et al., 2022; Gupta et al., 2023).
- Substantial heterogeneity in who *can* and who *wants* to RW.
- WFH positively correlated with wages.
- For those who want to RW can be a substantial benefit, like a company car often is.
- This paper: Quantify (this) impact of RW on inequality.

# Employers planned and actual remote working (% of days per week).



# Remote workability and wages



- UK Survey of Working Arrangements and Attitudes (SWAA-UK)
- Monthly data from Jan 2021 to Dec 2023 ( $n \approx 2500$  per month)
- Key questions:
  - **Q1: Employer's planned RW days post-Covid**
  - **Q2: Employee's desired RW days post-Covid**
  - **Q3: How much of a pay raise/cut (as a percent of your current pay) would you value as much as the option to work from home 2 or 3 days a week?**
- Summary: RW increasing from 1.2 to 2.1 days/week over sample period

# Descriptive Regressions

$$RW_{ij}^q = \alpha_0 + \alpha_1 \delta_{ij}^{RW} + \alpha_2 X_i + \alpha_3 Z_{ij} + e_{ij}, \quad q = Q1, Q2, Q3. \quad (1)$$

$$\delta_{ij}^{RW} = \pi_0 + \pi_1 DN_j + \pi_2 X_i + \pi_3 Z_{ij} + u_{ij} \quad (2)$$

where  $DN_j \in [0, 1]$  is the value of the Dingel & Neiman 2020 index for job  $j$ .

# Descriptive Regressions

**Table A2:** Planned and desired working from home after Covid-19

	Employer's planned RW			Employee's desired RW			Willingness to pay for RW		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Able to RW		36.75*** (0.437)	56.97*** (1.917)		31.34*** (0.565)	48.57*** (1.922)		3.926*** (0.223)	5.369*** (0.695)
Male	-1.819*** (0.498)	1.334** (0.443)	3.068*** (0.481)	-0.0182 (0.444)	2.335*** (0.410)	3.628*** (0.436)	-1.000*** (0.136)	-0.712*** (0.134)	-0.606*** (0.138)
Age	-0.0874*** (0.0202)	-0.0423* (0.0182)	-0.0174 (0.0192)	-0.172*** (0.0187)	-0.161*** (0.0176)	-0.155*** (0.0182)	-0.0594*** (0.00574)	-0.0597*** (0.00569)	-0.0599*** (0.00570)
Education	1.757*** (0.107)	0.935*** (0.0998)	0.482*** (0.112)	1.246*** (0.0938)	0.572*** (0.0879)	0.201* (0.0968)	0.323*** (0.0303)	0.260*** (0.0292)	0.237*** (0.0304)
(log) Income	10.46*** (0.540)	5.634*** (0.483)	2.977*** (0.552)	5.674*** (0.464)	2.342*** (0.433)	0.511 (0.471)	-0.765*** (0.157)	-1.126*** (0.156)	-1.259*** (0.169)
$\bar{Y}$	37.06	37.06	37.06		54.30	54.30	8.30	8.30	8.30
$\sigma Y$	36.82	36.82	36.82		34.80	34.80	9.71	9.71	9.71
First Stage			.422			.389			.353
Observations	33,112	33,112	33,112	44,680	44,680	44,680	35,689	35,689	35,689
$R^2$	0.23	0.38		0.14	0.26		0.03	0.05	
Estimator	OLS	OLS		OLS	OLS	2SLS	OLS	OLS	2SLS
Industry FE	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes

**Note:** The dependent variable in columns (1)–(3) is the answer to Q1 “After COVID, how often is your employer planning for you to work at home?” (in percentage, 0-100%). The dependent variable in columns (4)–(6) is the answer to Q2 “After COVID, how often would you like to have paid workdays at home?” (also in percentage points). Heteroscedasticity robust standard errors are shown in parentheses. In columns (3) and (6), the variable  $\delta_{ij}^{RW}$ , the ability to work remotely, as reported by the worker, is instrumented with the Dingel and Neiman (2020) index. Results are weighted to match the Labour Force Survey by age, gender, education, and location. Significance levels are: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , and \*  $p < 0.1$ .

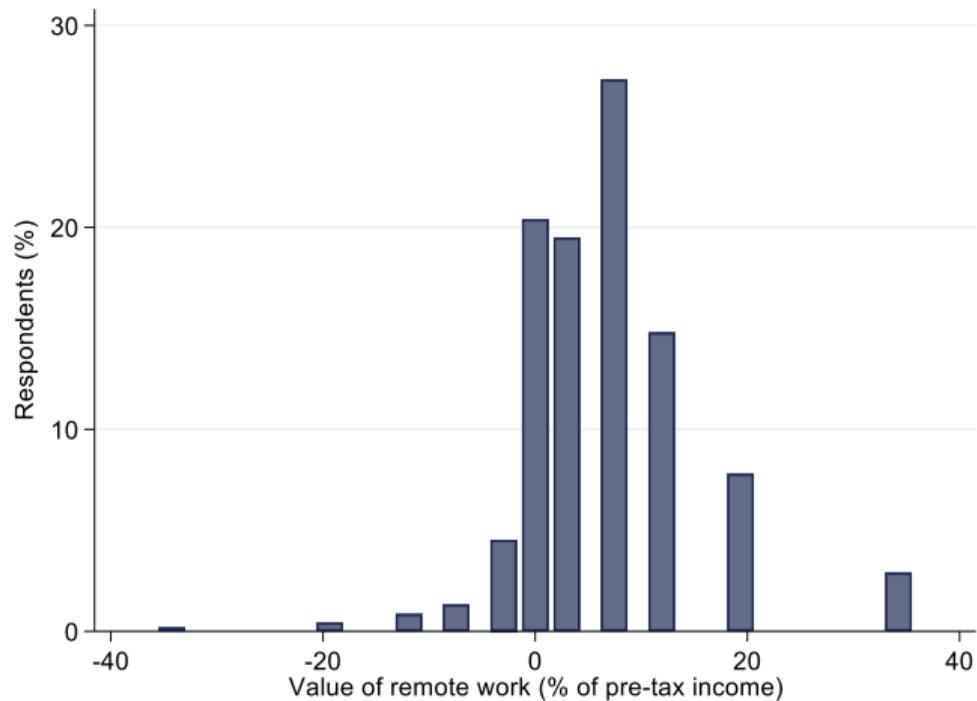
# Descriptive Regressions

**Table A3:** Planned and desired working from home after Covid-19: Commuting Variables

	Employer's planned RW			Employee's desired RW			Willingness to pay for RW		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Able to RW		37.71*** (0.682)	57.71*** (3.108)		31.71*** (0.904)	45.55*** (2.949)		3.603*** (0.341)	4.571*** (1.040)
Male	-0.390 (0.764)	2.231** (0.680)	3.622*** (0.723)	0.702 (0.693)	2.895*** (0.639)	3.853*** (0.670)	-0.794*** (0.223)	-0.546* (0.220)	-0.479* (0.226)
Age	-0.101** (0.0308)	-0.0374 (0.0277)	-0.00372 (0.0298)	-0.193*** (0.0295)	-0.167*** (0.0270)	-0.156*** (0.0275)	-0.0518*** (0.00939)	-0.0506*** (0.00929)	-0.0503*** (0.00931)
Education	1.503*** (0.165)	0.795*** (0.153)	0.420* (0.169)	1.099*** (0.150)	0.523*** (0.139)	0.271 (0.150)	0.262*** (0.0500)	0.216*** (0.0489)	0.204*** (0.0502)
(log) Income	7.226*** (0.842)	3.515*** (0.749)	1.546 (0.821)	3.303*** (0.770)	0.507 (0.705)	-0.713 (0.735)	-1.441*** (0.269)	-1.712*** (0.265)	-1.785*** (0.279)
Commuting time (mins)	0.200*** (0.0201)	0.122*** (0.0181)	0.0801*** (0.0190)	0.214*** (0.0175)	0.156*** (0.0163)	0.130*** (0.0169)	0.0361*** (0.00580)	0.0305*** (0.00571)	0.0290*** (0.00580)
Commuting cost (£100)	10.68*** (2.411)	9.638*** (2.198)	9.084*** (2.235)	4.315 (2.291)	3.629 (2.207)	3.330 (2.232)	0.907 (0.695)	0.868 (0.688)	0.857 (0.687)
$\bar{Y}$	39.37	39.37	39.37		55.86	55.86	8.58	8.58	8.58
$\sigma Y$	37.07	37.07	37.07		34.80	34.80	9.75	9.75	9.75
First Stage			.409			.4			.371
Observations	13747	13747	13747	16368	16368	16368	13104	13104	13104
$R^2$	0.25	0.40		0.18	0.29		0.03	0.05	
Estimator	OLS	OLS		OLS	OLS	2SLS	OLS	OLS	2SLS
Industry FE	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes

Note: See note for Table A2

# Distribution of Willingness to Pay



## Empirical Analysis: RW as a Non-Monetary Benefit

- Q3: Willingness to pay for RW (as % of salary) **per day** of WFH.
- Responses are constrained to a set of bands; we use the midpoint of each band as the valuation in terms of percent of salary. The maximum (minimum) value which can be chosen is *more than (less than) a 35% pay raise (pay cut)*. In both cases we take the value closer to 0, namely 35%. That is, summing up formally, if  $v_i$  is individual  $i$ 's answer to this question, then

$$v_i \in \{-0.35, -0.3, -0.2, -0.125, -0.075, -0.025, 0, 0.025, 0.075, 0.125, 0.2, 0.3, 0.35\}. \quad (3)$$

- $R_i$  is the number of days employer plans for WFH. We work with fraction of 2.5 days to be conservative.
- Realized RW benefit:  $v'_i = v_i \times \frac{1}{2.5} \min(R_i, 2.5)$
- RW-adjusted income:  $y_i = w_i(1 + v'_i)$
- Positive correlation between RW benefit and salary ( $\beta = 5.4, p \leq 0.001$ )

## But, in General Equilibrium...

Workers' Utility:

$$(a + \theta\lambda) U(w), \quad (4)$$

- with  $\theta \in [\underline{\theta}, \bar{\theta}] \subseteq [-1, 1]$
- Wage is  $w > 0$ ,
- $\lambda > 0$  is the amount of time spent RW.

The parameter  $a$  can be normalised away to 1. Thus, if a worker's  $\theta$  is close to 0, then the worker cares very little where she works, and a negative (positive)  $\theta$  indicates a dislike (a liking) for RW.

## But, in General Equilibrium...

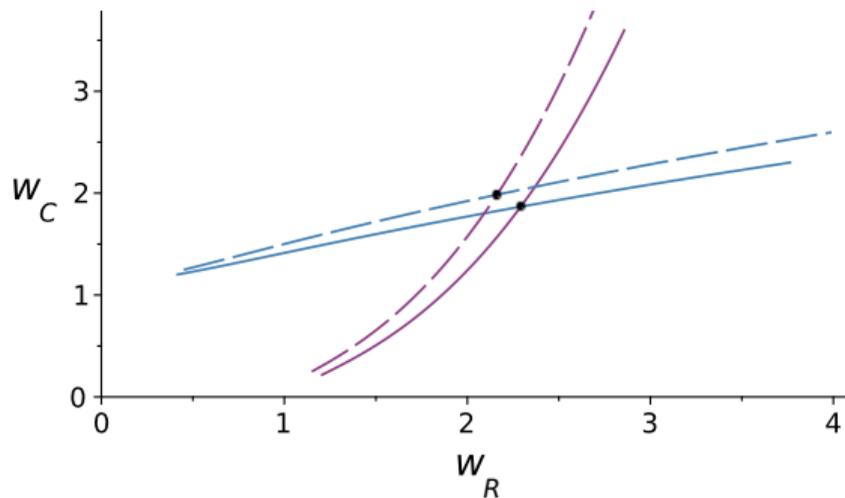
Production:

- The economy is made up of a continuum of industries, characterised by a parameter  $\alpha$ .
- In each industry  $\alpha$  a continuum of competitive firms produce their homogenous output, which is sold in a competitive product market at unit price 1, each using the same Cobb-Douglas production function with constant returns to scale.
- Firms use only two types of inputs, type  $R$  labour and type  $P$  labour: type  $R$  labour is executes tasks that can be done remotely, and type  $P$  involves tasks whiche require in person presence at the workplace.

$$\pi = A (\rho n_R^\gamma + (1 - \rho) n_C^\gamma)^{\frac{1}{\gamma}} - (w_R + \sigma_R \lambda_R) n_R - (w_C + \sigma_C \lambda_C) n_C, \quad (5)$$

where  $\sigma_R$  and  $\sigma_P$  the exogenously given extra cost of RW for type  $R$  and type  $P$  workers: in general  $\sigma_R < \sigma_P$ .  $A$  is the (product between the sales price and the) total factor productivity,  $\gamma$  is the substitution parameter, so that the constant elasticity of substitution between the two types of labour is  $\frac{1}{1-\gamma}$

Figure 1: The profit maximizing choice of the firm.



**Note:** The firm's “pseudo best reply functions”. The horizontal (vertical) axis measures the salary offered to type  $R$  ( $C$ ) workers. The steep red curves plot the best choice of  $w_R$ , for a given value of  $w_C$ ; the shallower blue curves plot the best choice of  $w_C$ , for a given value of  $w_R$ . The intersection of the solid (dashed) curve is the equilibrium prior to (following) a reduction of the cost of remote working for type  $R$  workers.

Table 1: Effects of changes in  $\sigma_R$

$\beta$	$G_{t-1}^Y$	$G_t^Y$	$\Delta G^Y$	$G_{t-1}^{comp}$	$G_t^{comp}$	$\Delta G^{comp}$
0.25	0.0599	0.0604	-0.0005	0.3293	0.3297	-0.0004
0.22	0.0613	0.0611	0.0002	0.3401	0.3403	-0.0002
0.19	0.0634	0.0623	0.0011	0.35357	0.35352	0.00005

**Note:** Computed Gini coefficient for the CES production model used as an example in this section. The table shows the effects of a 5% reduction in  $\sigma_R$ , from the original value of 1.8. The other parameters are fixed in all industries at  $\rho = 0.7$ ,  $\gamma = 0.25$ ,  $\alpha_R = \alpha_C = 30$ ,  $\eta_C = 500$ ,  $\sigma_C = 3.5$ . Thus,  $l = 36$ , and so there are 72 income levels, which differ according to the values of two of the remaining parameters,  $A$  and  $\eta_R$ :  $A \in \{1, 1.3, 1.7, 2, 2.1, 2.2, 2.3, 2.5, 2.7\}$  and  $\eta_R \in \{80, 100, 120, 150\}$ . Three scenarios are considered, which vary in the parameter  $\beta$  measuring the concavity of the utility function, each described in its own row in the table.

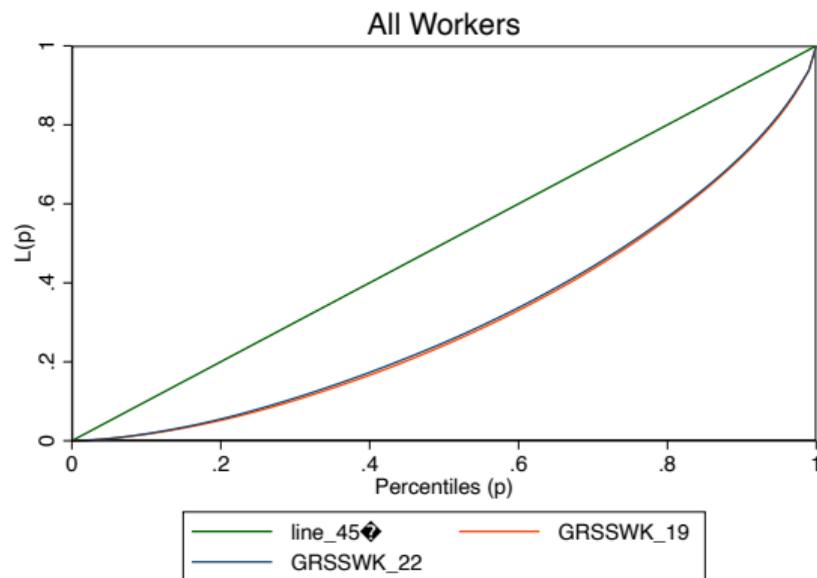
# Empirical Analysis: Changes Post-Pandemic (LFS)

Table 2: Wage Growth and Remote Work

	(1) All	(2) All	(3) No Hospitality	(4) All	(5) No Hospitality
Post-pandemic	0.147*** (0.00533)				
Post-pandemic × RW	-0.0204** (0.00868)	-0.0224*** (0.00841)	-0.0192** (0.00824)		
Work From Home				-0.0723** (0.0290)	-0.0624** (0.0285)
First Stage				.311	.307
Observations	213145	212698	203863	212468	203652
Clusters	369	369	369	369	369
$R^2$	0.0232	0.000126	0.0000923		
Estimator	OLS	OLS	OLS	IV	IV

- 14.7% wage increase post-pandemic
- 2% lower wage growth in remote-workable jobs

# Inequality Analysis



Gini decomposition:

$$G = \sum_{k=1}^K S_k G_k R_k = S_W G_W R_W + S_{WV} G_{WV} R_{WV} \quad (6)$$

Where  $G$  is the Gini coefficient of compensation,  $R_k$  is the correlation between the  $k$ -th component of compensation and total compensation,  $G_k$  is the Gini coefficient of the  $k$ -th component of compensation, and  $S_k$  is the share of the  $k$ -th component of compensation in total compensation (Lerman and Yitzhaki, 1985).

# Gini Decomposition

		$S_k$	$G_k$	$R_k$	Total
Panel A: $v_i' w_i$					
2019	$w_i$	0.9947	0.3140	0.9996	0.3157
	$v_i' w_i$	0.0053	0.9802	0.6622	
2023	$w_i$	0.9580	0.3008	0.9987	0.3071
	$v_i' w_i$	0.0420	0.5894	0.7795	
Panel B: $v_i^\dagger w_i$					
2019	$w_i$	1	0.3140	1	0.3140
	$v_i^\dagger w_i$	0			
2023	$w_i$	0.9580	0.3008	0.9987	0.3071
	$v_i^\dagger w_i$	0.0420	0.5894	0.7795	

**Note:** Results are from the Lerman (1985) decomposition of the Gini coefficients of total compensation, defined as income plus the in-kind benefit of RW, for 2019 and 2023.  $S_k$  is the share of each source of compensation in the total.  $G_k$  is the Gini coefficient of that source, and  $R_k$  is the correlation of that source with the overall Gini coefficient.  $v_i'$  is as defined in (??).  $v_i^\dagger$  assumes that the benefit of RW was 0 pre-pandemic.  $\tilde{v}$  fixes the number of days RW as 2 for all those able to RW.  $v_i^\ddagger$  replaces  $\min(R_i, 2.5)$  in (??) with  $R_i$ . Data are SWAA-UK with LFS weights

# Gini Decomposition

		$S_k$	$G_k$	$R_k$	Total
Panel C: $\tilde{v}w_j$					
2019	$w_j$	0.9944	0.3140	0.9996	0.3157
	$\tilde{v}w_j$	0.0056	0.9861	0.6367	
2023	$w_j$	0.9142	0.3008	0.9939	0.3074
	$\tilde{v}w_j$	0.0362	0.6348	0.7733	
Panel D: $v^\ddagger w_j$					
2019	$w_j$	0.9931	0.3142	0.9993	0.3165
	$v^\ddagger w_j$	0.0069	0.9811	0.6892	
2023	$w_j$	0.9466	0.3008	0.9978	0.3092
	$v^\ddagger w_j$	0.0534	0.5986	0.7854	

## Conclusion

- RW benefits skewed towards higher earners
- Lower wage growth, but higher overall compensation for RW jobs
- Limited change in inequality so far
- Ongoing nature of the shift to remote work
- Policy implications: monitoring and addressing disparities in RW access

## References

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**Alipour, Jean-Victor, Harald Fadinger, and Jan Schymik**, “My Home Is my Castle – The Benefits of Working from Home During a Pandemic Crisis Evidence from Germany,” *ifo Working Paper No. 329*, 2020, (178), 01–48.

**Althoff, Lukas, Fabian Eckert, Sharat Ganapati, and Conor Walsh**, “A New Spatial Hedonic Equilibrium in the Emerging Work-from-Home Economy?,” Working Paper, National Bureau of Economic Research August 2021.

**Barrero, Jose Maria, Nicholas Bloom, and Steven J Davis**, “Why working from home will stick,” Technical Report, National Bureau of Economic Research WP 28731, April 2021.

**Barrero, José María, Nicholas Bloom, and Steven J. Davis**, “The Evolution of Work from Home,” *Journal of Economic Perspectives*, 2023, 37 (4), 23–50.

**Fraja, Gianni De, Jesse Matheson, and James Rockey**, “Zoomshock: The geography and local labour market consequences of working from home,” *Covid Economics*, 2021, (64), 1–41.

**Lerman, Robert I. and Shlomo Yitzhaki**, “Income Inequality Effects by Income Source: A New Approach and Applications to the United States,” *The Review of Economics and Statistics*, 1985, 67 (1), 151–156.

**Office for National Statistics**, “Annual Survey of Hours and Earnings, 1997-2019: Secure Access. 16th Edition. UK Data Service. SN: 6689,” <http://doi.org/10.5255/UKDA-SN-6689-16> 2020.

— , “Labour Force Survey, 2017-2024: 11th Release. UK Data Service. SN: 2000026,” <https://doi.org/10.5255/UKDA-Series-2000026> 2023.