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Under the hood of the routine share decline ☆

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ABSTRACT

Using establishments' occupational data, we quantify the role of entrants, exiters, and incumbents in driving the decline in the share of routine occupations (R-share) in the U.S. First, entrants have a higher R-share than incumbents, casting doubt on a "creative destruction" mechanism whereby entrants drive this decline. Second, exiters have a higher R-share than their peers, supporting a "positive selection" mechanism. Finally, as incumbents age, they experience a fall in their R-share, which is not due to their size, consistent with the "technology adoption" mechanism. Quantitatively, we show that incumbents are the primary drivers of the aggregate decline in R-share.

1. Introduction

The decline in the share of employees working in routine occupations (*R-share* hereafter), known as job polarization, has been at the center of recent discussions (e.g., Autor et al., 2006, Goos and Manning, 2007, and Acemoglu and Autor, 2011).

Evidence on the R-share's evolution at the establishment level is limited. Using U.S. administrative micro-data of establishments' occupational employment, we address this gap. This research furthers our knowledge on the R-share decline and how establishments modify their labor force.

We document a decline over time in the R-share of incumbent, entering, and exiting establishments. For incumbents, this decline over their life cycle holds even after controlling for size and across different cohorts. While new cohorts of entrants exhibit a lower R-share than prior cohorts, entrants have a higher R-share than incumbents, even several years after birth, casting doubt on a "creative destruction" channel. Exiters, on the other hand, display a higher R-share than incumbents, both upon exit as well as in the years leading to their exit. This implies a negative, albeit very small, contribution to the R-share through selection. Ultimately, our findings point to the key role of incumbents in driving the decline in the R-share. Studies most related to ours include Heyman (2016), Bockerman et al. (2019), and Harrigan et al. (2021), all using micro-data of occupations at the establishment level. Heyman (2016) uncovers within-firm job polarization in Sweden without addressing the entry/exit margin. Bockerman et al. (2019) finds significant within-firm adjustments for the middle education group in Finland (a proxy for Routine occupations) and, unlike us, sees the entry margin as contributing to the R-share decline. Harrigan et al. (2021) identifies changes in firm composition, and not within-firm adjustments, as the primary driver of polarization in France. In contrast, we find within-establishment adjustments in the U.S. pivotal to the R-share decline. Overall, our contribution is to document the dynamics of entry and exit in the U.S. and enrich our understanding of the evolution of the R-share within incumbents.

2. R-share over time and across establishments

Our administrative data tracks occupational-level employment in approximately 1.2 million U.S. establishments, stratified to represent the economy from 1988 to 2013. Online Appendix A.1 provides more details.

We measure each establishment's share of routine-task labor by following the standard definition in the literature (e.g., the definition of Jaimovich and Siu (2020) described in Appendix A.2): Our main variable is an establishment's share of total employment in routine-task labor **(R-share)**:

$$\text{R-share}_{i,t} = \frac{\sum_o 1[o \in R] * emp_{o,i,t}}{\sum_o emp_{o,i,t}}. \quad (1)$$

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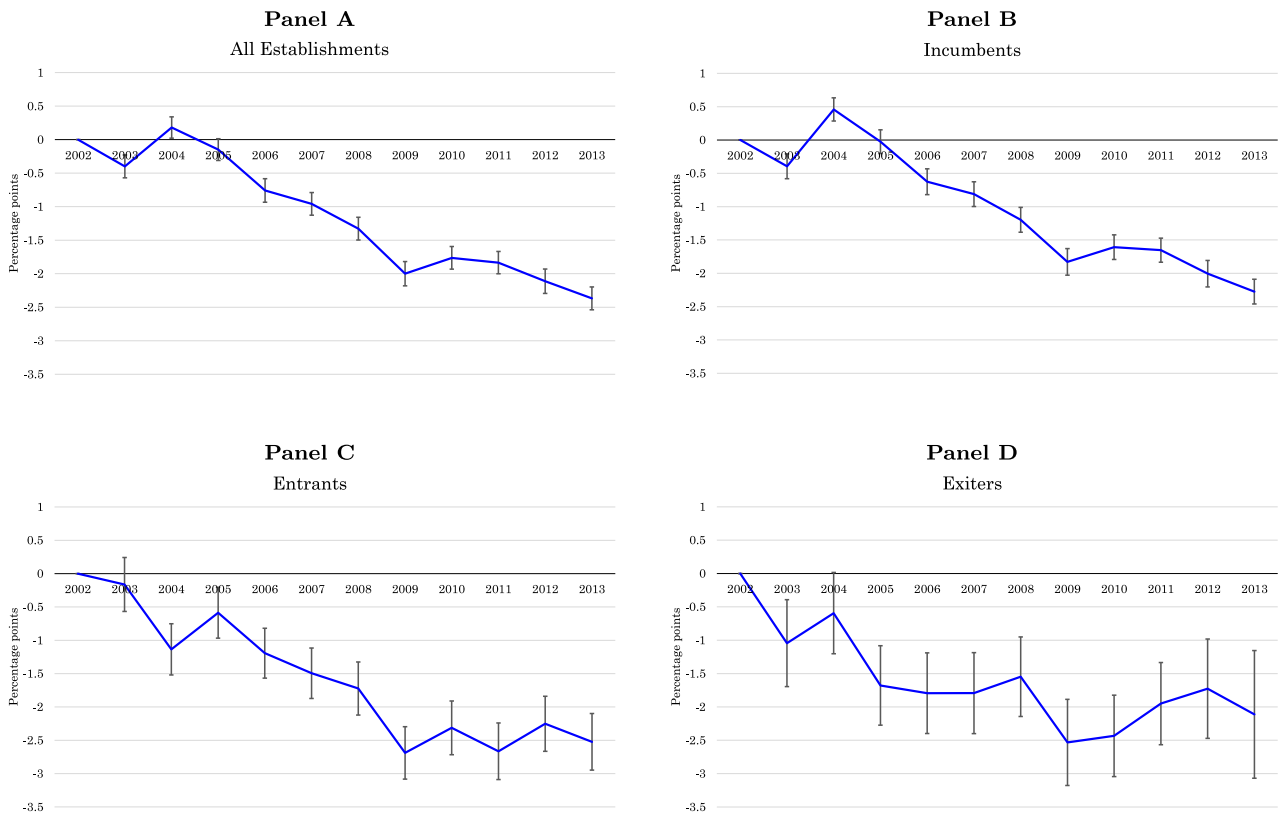

Fig. 1. Evolution of routine share. *Notes*: Panels A–D plot establishments' R-share evolution for all establishment types (see Eq. (2)). Vertical bars represent the point estimates' robust standard errors.

where o, i and t respectively refer to an occupation, establishment, and year.

We begin by regressing an establishment-level R-share on year dummies, while controlling for NAICS3 industry fixed effects for establishments in each age group from 2002 to 2013, where 2002 serves as the benchmark year[1]:

$$\text{R-share}_{i,t} = \sum_{t=2003}^{2013} \beta_t \times Year_t + FE_{NAICS3} + \epsilon_{i,t}, \tag{2}$$

Panels A to D in Fig. 1 depict the year-specific coefficients β_t for each establishment type (also shown in Table IA.1). They look strikingly similar: the decline in R-share is comparable for all three establishment types. In the subsequent sections, we explore in more detail the characteristics specific to each type.

2.1. Incumbents

We first regress an incumbent establishment's R-share on its age and establishment fixed effects,

$$\text{R-share}_{i,t} = \sum_j \gamma_j AgeGroup_j + FE_{Est} + \epsilon_{i,t}, \tag{3}$$

where $AgeGroup$ specifies seven 3-year age bins. γ_j captures an establishment's R-share as it ages, with the [0–2] age group serving as the baseline. Adding establishment fixed effects enables us to account for establishment-specific heterogeneity. This ensures that the observed changes in the R-share are attributable to the life cycle of the establishment.

Table 1's first column reveals that the R-share declines with age: compared to its initial level, an establishment's R-share drops by 2.4 ppt by ages [12–14] and 4 ppts by age 20. All differences are significant at the 1% level. Moreover, this conclusion holds even if we focus on different establishment cohorts, as shown in Columns (2)–(5).

Finally, considering that firms grow with age, we control for an establishment's or parent firm's size in columns (6) and (7). The age coefficients remain unaffected, confirming the lifecycle dimension of R-share dynamics.

2.2. Entrants and exiters

Next, we investigate whether creative destruction, through entry and/or exit, plays a significant role in the decline of the aggregate routine share. We start by running the following regression:

$$\text{R-share}_{i,t} = \theta_1 E_{i,t} + FE_{NAICS3 \times Year} + \epsilon_{i,t}, \tag{4}$$

where $E \in \{Entrant, Exiter\}$ is a dummy variable that equals one if establishment i is an entrant/exiter in year t. Industry interacted with time fixed effects are included.

Column (1) of Table 2 reports the coefficient θ_1 when we only include the entrant dummy. The result shows that, on average, firms at entry are characterized by a *higher* R-share than their incumbent industry peers, a difference of 0.34 ppt. This casts doubt on the contribution of entrants through a creative destruction channel, whereas they would be more likely to enter with newer technologies (and have lower R-share) than incumbents. On the other hand, Column (2) shows that in the exiter's last year of existence, the R-share was 0.44 ppt higher

[1] Throughout the paper, all observations are weighted by the product of the establishment's total employment and the BLS sampling weight. We report robust standard errors.

Table 1
Within incumbents R-share.

	All (1)	1990 Cohort (2)	1995 Cohort (3)	2000 Cohort (4)	2005 Cohort (5)	All (6)	All (7)
Age [3–5]	−0.623***			−0.692***	−0.539***	−0.623***	−0.625***
	(0.105)			(0.166)	(0.147)	(0.105)	(0.105)
Age [6–8]	−1.235***		−0.544**	−1.343***	−1.135***	−1.234***	−1.237***
	(0.123)		(0.229)	(0.173)	(0.225)	(0.124)	(0.123)
Age [9–11]	−1.914***	−0.826	−1.333***	−1.861***		−1.912***	−1.917***
	(0.142)	(0.809)	(0.229)	(0.195)		(0.143)	(0.142)
Age [12–14]	−2.414***	−1.199	−1.806***	−2.797***		−2.413***	−2.419***
	(0.163)	(0.806)	(0.237)	(0.362)		(0.163)	(0.163)
Age [15–17]	−2.975***	−1.926**	−2.183***			−2.974***	−2.978***
	(0.184)	(0.828)	(0.266)			(0.184)	(0.184)
Age [18–20]	−3.658***	−2.604***	−2.029***			−3.657***	−3.660***
	(0.211)	(0.815)	(0.582)			(0.211)	(0.211)
Age [21–22]	−3.998***	−2.897***				−3.997***	−4.001***
	(0.310)	(0.850)				(0.310)	(0.310)
Log(Emp)						−0.015	0.064
						(0.110)	(0.058)
N	1,280,804	292,775	363,542	402,364	212,605	1,280,804	1,280,804
R^2	0.91	0.91	0.91	0.90	0.92	0.91	0.91

Notes: Results of regressing establishment routine share on its age with establishment fixed effects. The benchmark age for all columns is Age [0–2], except for Columns (2) and (3) where the benchmark is Age [6–8] and Age [3–5], respectively. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 2
R-share: Entrants & exiters.

	(1)	(2)	(3)
Entrant	0.335***		0.310***
	(0.083)		(0.083)
Exiter		0.439***	0.412***
		(0.127)	(0.128)
N	3,032,548	3,010,740	3,010,740
R^2	0.66	0.66	0.66

Notes: Results of regressing establishment routine share on entrant and exiter dummy with NAICS3-Year fixed effects. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

Table 3
Decomposition of routine share change.

Total	Within	Chg. weight	Cross-term	Net entry	Net entry	
					Entry	Exit
−1.99	−1.74	−1.03	0.10	0.68	0.69	0.01

than that of its peers. Column (3) confirms similar outcomes when both dummies are included.[2]

Next, we study R-share dynamics *around* entry or exit. First, for each entering establishment in period t, we track its R-share in $t+1, \ldots, t+7$ relative to its incumbent peers by estimating the following regression:

$$\text{R-share}_{i,t} = \lambda^E_\tau Entrant(-\tau)_{i,t} + FE_{NAICS3-Year} + \epsilon_{i,t}, \quad (5)$$

where $Entrant(-\tau)_{i,t}$ is equal to one if establishment i was an entrant τ years ago, and zero otherwise, up to $\tau = 7$. We exclude establishments younger than τ.

Panel A of Fig. 2 depicts λ^E_τ. We find no evidence that following entry, new establishments on average ever display a lower R-share than their peers. This confirms that the entry margin does not contribute to the overall decline in R-share.[3]

Next, we turn to the dynamics prior to exit. For each exiting establishment in period t, we estimate its R-share in $t-7, \ldots, t-1$ relative to incumbents by running the following regression:

$$\text{R-share}_{i,t} = \lambda^X_\tau Exiter(\tau)_{i,t} + FE_{NAICS3-Year} + \epsilon_{i,t}, \quad (6)$$

where $Exiter(\tau)_{i,t}$ is a dummy variable that is equal to one if establishment i will be an exiter in τ years, and zero if the establishment will survive beyond τ years.

Panel B of Fig. 2 depicts the coefficients λ^X_τ. We find that exiters had a significantly higher R-share than their incumbent peers many years before their eventual death. Hence, exiters fall behind their surviving peers' R-share evolution years before exit, and are not simply the victims of an exit-inducing shock.

2.3. A decomposition of the evolution of the routine share

Finally, we show in Table 3 the result of a Melitz-Polanec decomposition of the within-industry R-share. We find that 1.74 ppt out of the total 1.99 ppt fall in the R-share is coming from the within-incumbent margin, with another 1.03 from shifts in weights across incumbents. The contribution of entry, at 0.69, is *positive*, in line with our earlier results. That of exit, while negative, is very small (−0.01). The cross-term rounds out the total, at 0.1.

All in all, the decomposition confirms that incumbent establishments are the main drivers of the decline in the U.S. R-share.

3. Conclusions

Over time, entrants, exiters and incumbents all exhibit a reduction in their routine employment share. The driving factor for the R-share decline is the fall in incumbents' R-share as they age. Thus, research on R-share reduction should focus on occupational dynamics within existing establishment.

Data availability

The authors do not have permission to share data.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.econlet.2023.111437.

[2] Focusing only on establishments with over 20 employees does not change this result (see Table IA.2).

[3] Focusing only on entrants that never exit later in the sample does not change this result (see Figure IA.1).

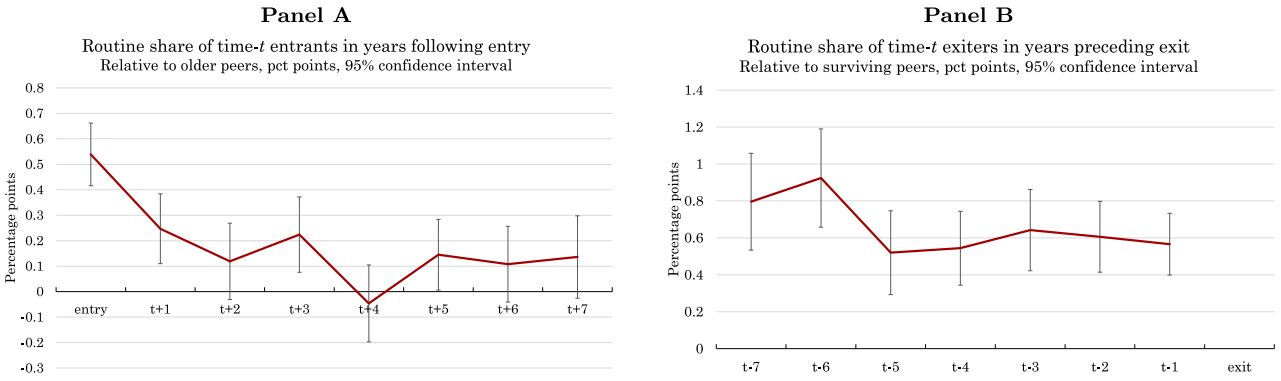

Fig. 2. Routine share dynamics of entrants and exiters. *Notes*: Panel A plots entrants' R-share relative to their existing incumbent peers. Panel B plots exiters' R-share relative to their surviving incumbent peers.

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