

Technological Progress and the Dynamics of Self-Employment: Worker-level Evidence for Europe

Ronald Bachmann ¹ Myrielle Gonshor ² Santo Milasi ³ Alessio Mitra ⁴

¹RWI, DICE/HeinrichHeine-Universität Düsseldorf

²RWI, DICE/HeinrichHeine-Universität Düsseldorf

⁴European Commission, University of Kent

³European Commission (JRC)

Key elements of the paper

- What are the individual-level and occupation-level determinants of the transitions to and from self-employment?
- Does technological progress, and particularly digital technologies, affect the transitions from paid employment and self-employment and vice versa?

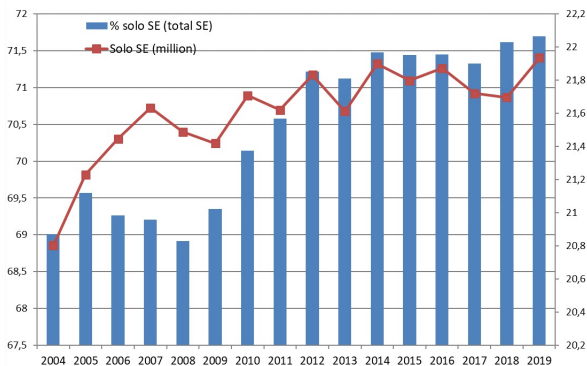


Contribution

- Distinguish between solo SE and SE with employees
- Empirical evidence on the socio-economic and demographic characteristics explaining the transitions
- Empirical evidence on the role of digital technologies in explaining the transitions

Key figures on solo SE in the EU

Solo self-employment has become an increasingly prominent feature of the labour market in several European countries.



- 23 million solo SE in the EU – 15% more than in 2002
- Solo SE accounts for 72% of all SE and for 10% of all employed
- 42% of solo SE are in technical, professional and managerial occupations (up from 36% in 2012)

Theoretical explanations for the rise of solo SE

- Strict labour market regulation encouraging firms to contract out work
- Digital technologies and platforms that facilitate the online provision of services remotely from freelancers
- Growing shares of women and older workers
- Changing workers' preferences; valuing more work-time flexibility and autonomy
- Lack of viable alternative in wage employment

Technology and market transitions

- Labour-saving technologies:
 - ▶ higher risks of unemployment, so transition to self-employment
 - ▶ lower levels of education, access to financial resources, so no transition to self-employment
- Labour-augmenting technologies:
 - ▶ more training and opportunity to grow, higher opportunity costs of leaving wage employment, so no transition to self-employment
 - ▶ more access to financial resources and ability to see business opportunities, so transition to self-employment

Data

- EU-SILC and SOEP for 30 European countries and 8 occupations at the ISCO-08 2-digit level for each year from 2014 to 2019.
- Mihaylov and Tijdens (2019) for three indicators capturing the intensity of routine tasks: routine manual tasks (RM), routine cognitive tasks (RC), and routine total (RT).
- Felten et al. (2019) for advances in AI.
- Fernández-Macías and Bisello 2020 for indicators on the intensity of physical, intellectual, and social tasks.

Panel regression - multinomial logit model

$$Pr(y = m|X) = \frac{\exp(X'\beta_{m|b})}{\sum_{j=1}^J \exp(X'\beta_{j|b})}, m = 1, \dots, j \quad (1)$$

- y is one of the five destination states (paid employment, self-employment with employees, solo self-employment, unemployment, and inactivity)
- b is one of the three origin states (unemployment, paid employment and solo self-employment t)
- X is the vector of explanatory variables which controls for gender, age, marital status, number of children, education level, and work characteristic, technology etc

Transition probabilities from employment: Individual and job characteristics

Multinomial logit regression

	stays employed	entry into SE w/employees	entry into solo SE	entry into unemployment	entry into inactivity
Women	-0.0085*** (0.0021)	-0.0006*** (0.0002)	-0.0026*** (0.0006)	-0.0014 (0.0016)	0.0131*** (0.0010)
Age 16-29	-0.0324*** (0.0044)	0.0001 (0.0003)	0.0012 (0.0008)	0.0044*** (0.0016)	0.0267*** (0.0034)
Age 55-65	-0.0605*** (0.0039)	-0.0003 (0.0002)	-0.0010* (0.0006)	0.0041*** (0.0014)	0.0577*** (0.0034)
(Pre-)primary and lower secondary education	-0.0131*** (0.0027)	-0.0004* (0.0002)	0.0007 (0.0005)	0.0073*** (0.0018)	0.0055*** (0.0018)
Tertiary education	0.0101*** (0.0024)	0.0004 (0.0002)	0.0027*** (0.0008)	-0.0091*** (0.0015)	-0.0041*** (0.0011)
Married	0.0018 (0.0015)	0.0003 (0.0002)	-0.0002 (0.0004)	-0.0087*** (0.0008)	0.0068*** (0.0011)
No. of children in household	-0.0007 (0.0014)	0.0000 (0.0001)	0.0008** (0.0003)	0.0008 (0.0006)	-0.0010 (0.0011)
Part-time	-0.0235*** (0.0023)	-0.0002 (0.0003)	0.0024*** (0.0009)	0.0062*** (0.0012)	0.0152*** (0.0020)
Temporary work contract	-0.0638*** (0.0033)	-0.0001 (0.0003)	0.0050*** (0.0010)	0.0445*** (0.0025)	0.0144*** (0.0016)
Top 20% of wage distribution	0.0000 (0.0025)	-0.0001 (0.0002)	-0.0012 (0.0008)	-0.0078*** (0.0013)	0.0090*** (0.0021)
Year FE	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes
Mean Transition Probability	0.944	0.002	0.004	0.024	0.026
Observations	527,359	527,359	527,359	527,359	527,359

Source: EU-SILC 2014-2019, SOEP v.36. - Notes: Marginal effects from a multinomial logit regression with five outcomes. Robust standard errors in parentheses, clustered at two-digit occupational level with * p < 0.1, ** p < 0.05, *** p < 0.01. The observations are weighted using the two-year longitudinal weights. The reference group is employed, male, not-married, age 30-55, has (upper) secondary and post-secondary education, has no children. Country and year fixed-effects. Based on the two-year longitudinal sample.

Transition probabilities from paid employment: Digitization indices

Multinomial logit regressions by digitization index

	stays employed	entry into SE w/employees	entry into solo SE	entry into unemployment	entry into inactivity
AI Felten index	0.00615** (0.00248)	0.00025 (0.00029)	0.00090* (0.00047)	-0.00664*** (0.00163)	-0.00066 (0.00082)
Task intensity					
Routine tasks	0.00081 (0.00363)	-0.00101* (0.00061)	-0.00283* (0.00171)	0.00306 (0.00260)	-0.00003 (0.00170)
Routine-cognitive tasks	0.00194 (0.00391)	-0.00023 (0.00051)	-0.00198 (0.00153)	0.00111 (0.00276)	-0.00083 (0.00202)
Routine-manual tasks	-0.00069 (0.00800)	-0.00276** (0.00112)	-0.00394** (0.00184)	0.00523 (0.00474)	0.00215 (0.00220)
Physical tasks	-0.01397 (0.00976)	-0.00111 (0.00112)	0.00026 (0.00317)	0.01037 (0.00654)	0.00446 (0.00444)
Intellectual tasks	0.01929*** (0.00712)	0.00183* (0.00105)	0.00275* (0.00148)	-0.01846*** (0.00435)	-0.00541 (0.00396)
Social tasks	0.02229** (0.00981)	0.00445*** (0.00142)	0.00243 (0.00272)	-0.02772*** (0.00672)	-0.00144 (0.00404)
Year FE	yes	Yes	yes	yes	yes
Country FE	yes	Yes	yes	yes	yes
Mean Transition Probability	0.944	0.002	0.004	0.024	0.027
Observations	505,499	505,499	505,499	505,499	505,499

Source: EU-SILC 2014-2019, SOEP v.36, AI and task indices: Felten et al. (2018), Mihaylov & Tjidsens (2019), European tasks database & JRC Eurofound (2021).

– Notes: Marginal effects from multinomial logit regressions with five outcomes. Separate regressions for each technology indicator. Robust standard errors in parentheses, clustered at two-digit occupational level with * p < 0,1, ** p < 0,05, *** p < 0,01. The observations are weighted using the two-year longitudinal weights. The reference group is employed, male, not-married, age 30-55, has (upper) secondary and post-secondary education, has no children, works fulltime, has a permanent job, and is in the lower 80 percent of the wage distribution. Country and year fixed-effects. Based on the two-year longitudinal sample.

Transition probabilities from solo self-employment: Individual and job characteristics

Multinomial logit regression

	stays solo SE	entry into employment	entry into SE w/employees	entry into unemployment	entry into inactivity
Women	0.0025	-0.0056	-0.0145***	0.0044**	0.0131***
	-0.0103	-0.0048	-0.0045	-0.0022	-0.004
Age 16-29	-0.0409***	0.0212**	-0.0125**	0.0166***	0.0156**
	-0.0113	-0.0105	-0.0055	-0.0059	-0.0066
Age 55-65	-0.002	-0.0238***	-0.0090***	0.0017	0.0331***
	-0.008	-0.0041	-0.0033	-0.0021	-0.004
(Pre-)primary and lower secondary education	0.006	-0.0062	-0.0074**	0.0111**	-0.0036
	-0.008	-0.0057	-0.0035	-0.0047	-0.0033
Tertiary education	-0.0042	0.0104**	-0.0009	-0.0004	-0.0050*
	-0.0073	-0.0042	-0.0043	-0.0014	-0.0029
Married	-0.0103	-0.0026	0.0145***	-0.0055***	0.004
	-0.0067	-0.0023	-0.0037	-0.0019	-0.003
No. of children in household	-0.0037	0.0027	0.0001	0.0007	0.0002
	-0.0033	-0.0021	-0.002	-0.0013	-0.0018
Top 20% of cash income distribution	0.0757***	-0.0672***	0.0284***	-0.0104***	-0.0265***
	-0.0123	-0.0081	-0.0046	-0.0018	-0.0041
Year FE	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes
Mean Transition Probability	0.863	0.043	0.059	0.014	0.021
Observations	44,281	44,281	44,281	44,281	44,281

Source: EU-SILC 2014-2019, SOEP v.36. – Notes: Marginal effects from a multinomial logit regression with five outcomes. Robust standard errors in parentheses, clustered at two-digit occupational level with * p < 0.1, ** p < 0.05, *** p < 0.01. The observations are weighted using the two-year longitudinal weights. The reference group is self-employed, male, not-married, age 30-55, has (upper) secondary and post-secondary education, has no children, works fulltime, has a permanent job, and is in the lower 80 percent of the cash income distribution. Country and year fixed-effects. Based on the two-year longitudinal sample.

Transition probabilities from solo self-employment: Digitization indices

Multinomial logit regressions by digitization index

	stays solo SE	entry into employment	entry into SE w/employees	entry into unemployment	entry into inactivity
AI Felten index	-0.00656 (0.00580)	0.00630** (0.00287)	0.00575 (0.00557)	0.00072 (0.00229)	-0.00621* (0.00362)
Task intensity:					
Routine tasks	0.00264 (0.01866)	-0.00012 (0.01147)	0.00322 (0.01158)	-0.00295 (0.00448)	-0.00279 (0.00877)
Routine-cognitive tasks	0.00634 (0.02144)	0.00139 (0.01368)	-0.00122 (0.01469)	-0.00293 (0.00445)	-0.00358 (0.01041)
Routine-manual tasks	-0.00520 (0.01880)	-0.00379 (0.01188)	0.01065 (0.01466)	-0.00160 (0.00696)	-0.00005 (0.00640)
Physical tasks	0.08606*** (0.02606)	-0.05017*** (0.01052)	-0.03311* (0.01882)	0.01551** (0.00678)	-0.01828* (0.01069)
Intellectual tasks	-0.07767*** (0.02483)	0.05042*** (0.01217)	0.04228** (0.02103)	-0.00679 (0.00493)	-0.00824 (0.01254)
Social tasks	-0.11022*** (0.03612)	0.05770*** (0.01434)	0.06804** (0.02715)	-0.01607*** (0.00512)	0.00056 (0.01694)
Year FE	yes	yes	yes	yes	yes
Country FE	yes	yes	yes	yes	yes
Mean Transition Probability	0.866	0.04	0.059	0.014	0.021
Observations	43,047	43,047	43,047	43,047	43,047

Source: EU-SILC 2014-2019, SOEP v.36, AI and task indices: Felten et al. (2018), Mihaylov & Tjebens (2019), European tasks database & JRC Eurofound (2021).

– Notes: Marginal effects from multinomial logit regressions with five outcomes. Separate regressions for each technology indicator. Robust standard errors in parentheses, clustered at two-digit occupational level with * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The observations are weighted using the two-year longitudinal weights. The reference group is self-employed, male, not-married, age 30-55, has (upper) secondary and post-secondary education, has no children, works fulltime, has a permanent job, and is in the lower 80 percent of the cash distribution. Country and year fixed-effects. Based on the two-year longitudinal sample.

Conclusions

- Little evidence of entrepreneurial drive, more evidence that shifts from paid jobs to solo SE happen when nothing better is available
- Greater exposure to AI, on average, is positive for job prospects, yet low-paid/educated employees become more likely to move to solo SE
- Self employment may not be a viable alternative for employees in routine-intensive occupations
- Social and intellectual intensive tasks enhance job opportunities

Solo self-employment and lack of alternatives in wage employment: an occupational perspective

Santo Milasi ¹ Alessio Mitra ²

¹European Commission (JRC)

²European commission, University of Kent

Key elements of the paper

Do individuals opt into solo self-employment due to lack of viable alternative in wage employment? (Out of necessity, not entrepreneurship)



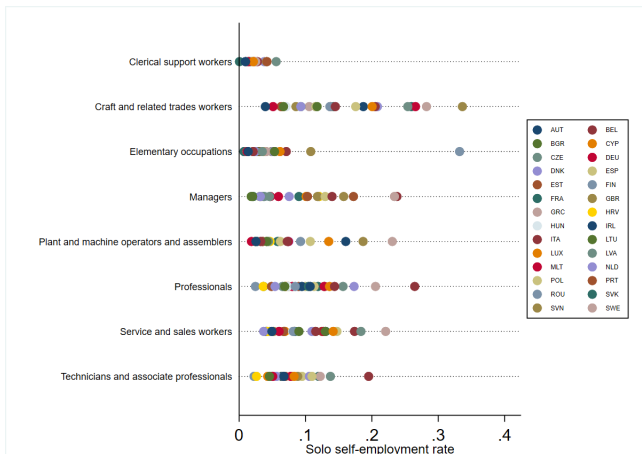
Contribution

- Distinguish between solo SE and SE with employees
- Look at both stock and flows into self-employment
- Empirical evidence on the role of wage employment opportunities in explaining the solo self-employment rate

Data

We employ data from the EU-LFS for 28 European countries and 8 occupations at the ISCO-08 1-digit level for each year from 2012 to 2019.

Figure: Solo self-employment rate heterogeneity by country-occupation (2012-2019)



Indicator of wage employment opportunities

$$WageEmploymentScarcity = \frac{NewlyUnemployed}{NewlyWageEmployed}$$

- *NewlyUnemployed*: Unemployed people who were previously working in a given occupation-country pair and lost their job over the previous 12 months
- *NewlyWageEmployed*: Newly employed in the wage sector, namely those who started their job over the previous 12 months within the same occupation-country

Method

Panel regression

$$\text{SoloSE}(\text{rate/flow})_{c,o,t} = \alpha_{c,o,t} + \beta \text{WageEmploymentScarcity}_{c,o,t} + \gamma X_{c,o,t} + \varepsilon_{c,o,t} \quad (1)$$

- $\text{SoloSE}(\text{rate})_{c,o,t}$: share of solo self-employed in total employment in country 'c' for the occupation category 'o' in the year 't'.
- $\text{SoloSE}(\text{flow})_{c,o,t}$: share of solo self-employment among the newly employed
- $X_{c,o,t}$: labour market controls such as share of older workers, share of highly educated workers and share of women workers.
- $\alpha_{c,o,t}$: country, year, occupation fixed effects, and their interactions

Results

	Solo self-employment rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Wage employment scarcity	0.0620*** (0.0167)	0.0492** (0.0152)	0.0584*** (0.0137)	0.0358*** (0.00933)	0.0171** (0.00513)	0.0218*** (0.00487)
N. observations	1495	1318	1318	1318	1306	1306
N. clusters	206	190	190	190	181	181
R^2	0.069	0.260	0.463	0.692	0.988	0.989
Socio-economic controls		X	X	X	X	X
Country FE			X	X	X	X
Year FE			X	X	X	X
Occupation FE				X	X	X
Country $\times$ Occupation FE					X	X
Country $\times$ Year FE					X	X
Occupation $\times$ Year FE						X

Note: Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors (in parentheses) clustered at the country-occupation level. Socio-economic controls include: share of older workers, share of highly educated workers, share of women workers.

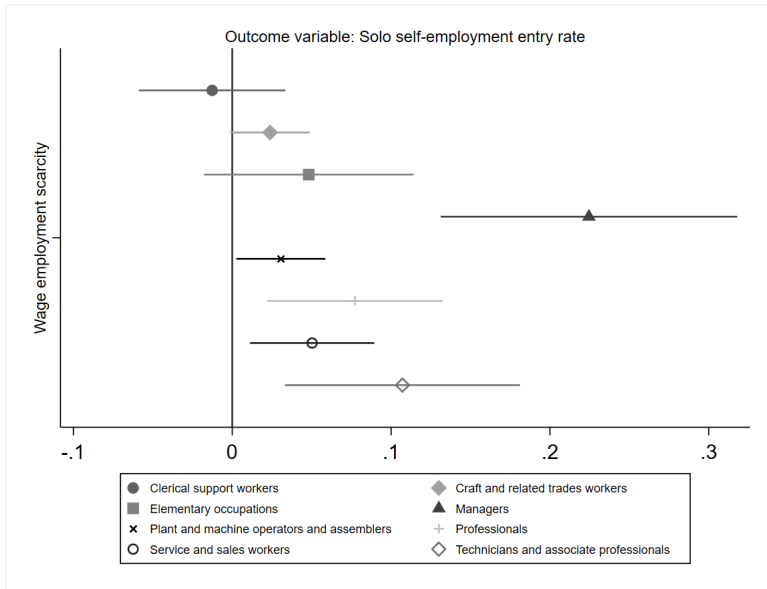
An increase of 10 percentage points in scarcity of wage employment opportunities is associated to an increase of around 0.2 percentage points in the solo self-employment rate.

	Solo self-employment entry rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Wage employment scarcity	0.0864** (0.0377)	0.0946** (0.0414)	0.147** (0.0556)	0.0958** (0.0321)	0.0439 (0.0266)	0.0621** (0.0273)
N.observations	843	782	781	781	736	736
N. clusters	138	129	128	128	113	113
R^2	0.102	0.225	0.599	0.723	0.965	0.972
Socio-economic controls		X	X	X	X	X
Country FE			X	X	X	X
Year FE			X	X	X	X
Occupation FE				X	X	X
Country $\times$ Occupation FE					X	X
Country $\times$ Year FE					X	X
Occupation $\times$ Year FE						X

Note: Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard errors (in parentheses) clustered at the country-occupation level. Socio-economic controls include: share of older workers, share of highly educated workers, share of women workers.

Wage employment opportunities affect more directly the flows into self-employment rather than the stock of self-employment in a given occupation-country.

Figure: Coefficient heterogeneity by occupation



Conclusions

- Lack of wage employment opportunities partly explains entry into (and persistence of) solo SE.
- Some occupation, which typically require high education attainment, are more sensitive than others .
- More attention on growth of solo SE vis-a-vis occupation-specific wage employment environment (including outsourcing, and other alternative work arrangements).