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Enterprise artificial intelligence adoption and solo self-employment in knowledge-intensive activities: an ecological study across European countries

Adopción empresarial de inteligencia artificial y autoempleo en solitario en actividades intensivas en conocimiento: un estudio ecológico en países europeos

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ABSTRACT

Introduction: Whether the diffusion of artificial intelligence among firms is associated with the level of one-person self-employment in knowledge-intensive activities is not established at the country level. Methods: An ecological cross-sectional study of the 27 European Union member states combined the 2024 share of enterprises using artificial intelligence (Eurostat) with the 2023 share of total employment accounted for by self-employed persons without employees in knowledge-intensive services, and estimated crude and GDP-adjusted associations. Results: Enterprise artificial intelligence adoption averaged 14.3 percent (SD 7.2) and solo self-employment in knowledge-intensive services averaged 2.0 percent of employment (SD 1.0). In the crude analysis the association was weak and not significant (β = 0.017 percentage points per percentage point of adoption, 95% CI −0.037 to 0.072, p = 0.524), and it attenuated after adjustment for gross domestic product per capita (β = −0.005, 95% CI −0.088 to 0.078, p = 0.898). Conclusions: Enterprise artificial intelligence adoption was not significantly associated with solo self-employment in knowledge-intensive activities across European countries, and the association was not confounded in a direction that would suggest a positive relationship after adjustment.

Keywords: solo self-employment; artificial intelligence; knowledge-intensive services; Europe; ecological study

RESUMEN

Introducción: Si la difusión de la inteligencia artificial entre las empresas se asocia con el nivel de autoempleo unipersonal en actividades intensivas en conocimiento no está establecido a nivel de país. Métodos: Un estudio ecológico transversal de los 27 Estados miembros de la Unión Europea combinó la proporción de empresas que usan inteligencia artificial en 2024 (Eurostat) con la proporción del empleo total correspondiente a trabajadores por cuenta propia sin asalariados en servicios intensivos en conocimiento en 2023, y estimó asociaciones crudas y ajustadas por producto interior bruto. Resultados: La adopción empresarial de inteligencia artificial promedió 14,3 por ciento (DE 7,2) y el autoempleo en solitario en servicios intensivos en conocimiento promedió 2,0 por ciento del empleo (DE 1,0). En el análisis crudo la asociación fue débil y no significativa (β = 0,017 puntos porcentuales por punto porcentual de adopción, IC 95 % −0,037 a 0,072, p = 0,524), y se atenuó tras ajustar por producto interior bruto per cápita (β = −0,005, IC 95 % −0,088 a 0,078, p = 0,898). Conclusiones: La adopción empresarial de inteligencia artificial no se asoció de forma significativa con el autoempleo en solitario en actividades intensivas en conocimiento entre los países europeos, y la asociación no se confundió en una dirección que sugiriera una relación positiva tras el ajuste.

Palabras clave: autoempleo en solitario; inteligencia artificial; servicios intensivos en conocimiento; Europa; estudio ecológico

INTRODUCTION

Solo self-employment, the situation of a person who works in their own business without hiring employees, has become a structurally important and widely studied policy-contested form of work in Europe.[1] It spans a heterogeneous population, from the freelance consultant to the platform driver, and its growth raises questions about autonomy, protection and the future of work that European labour-market institutions are still absorbing.[2] The policy stakes are high precisely because the category sits at the boundary between employment and entrepreneurship, a boundary that digital platforms and artificial intelligence are now redrawing, and the welfare consequences of that redrawing depend on whether solo work is a path to autonomy or a form of precarity. The population is not only heterogeneous across occupations but across the life course: solo self-employment is entered in later life by some workers as a pathway to autonomy,[3] and its retirement transition differs systematically from that of employer-owned businesses.[4] The institutional treatment of this population is equally uneven, with some countries extending unemployment insurance to the solo self-employed and others leaving them outside the social-security perimeter.[5] The knowledge-intensive segment of solo self-employment is of particular interest, because it is there that the labour-market consequences of artificial intelligence would be expected to appear first, given the exposure of cognitive and creative occupations to the technology.[6]

The relationship between artificial intelligence and self-employment is theoretically ambiguous. On one side, the technology is argued to lower the barriers to founding a one-person business by automating the non-core tasks that a solo worker would otherwise perform, a view developed in the entrepreneurship literature.[7,8] The solopreneurship thesis extends this logic to claim that artificial intelligence and digital platforms produce a structural convergence toward one-person firms.(9) On the other side, artificial intelligence may substitute for precisely the knowledge work that solo professionals sell, or may raise the returns to scale in ways that favour larger employers, a tension formalised in the task-based framework of technological change.[10,11] The exposure of occupations to large language models is broad but uneven, concentrated in the cognitive and writing tasks that knowledge-intensive solo work is built on.(12) The empirical record at the worker level is mixed: technological progress appears to reshape self-employment differently across sectors and worker types,(13) the digital-platform economy has produced new hybrid forms of solo work whose welfare effects are themselves contested,(14) and online platform workers differ sharply in their preferences for the support and protections that a solo worker might seek.(15) At the firm level, the adoption of artificial intelligence is itself uneven, concentrated in larger and more capable enterprises and shaped by a country's digital and skill endowments,[16,17] and the European evidence links enterprise digital transformation to employment outcomes in technologically advanced and knowledge-intensive sectors specifically.(18)

What is missing is a country-level test that connects the two sides of the debate. Existing studies examine either the determinants of enterprise artificial intelligence adoption(19) or the dynamics of self-employment,(20) but rarely both in the same frame, and the ecological association between a country's enterprise artificial intelligence adoption and the size of its knowledge-intensive solo self-employment has not, to our knowledge, been estimated. A country-level test is a natural complement to the worker- and firm-level evidence, because it captures the institutional and compositional forces, regulation, social protection, sectoral structure and skill supply, that individual-level designs hold fixed, and because a strong technology effect, if it existed, should survive aggregation to the country level even if the ecological fallacy forbids reading that aggregate back onto individuals. In short, a country-level design trades individual-level precision for coverage of the institutional environment in which the relationship is embedded. The European Union is the appropriate setting for such a test, because its member states share a statistical framework while differing widely in both adoption and self-employment, which is precisely the variation an ecological design requires. This study supplies that estimate using harmonised Eurostat data for the twenty-seven member states of the European Union. The objective was to estimate the crude and gross-domestic-product-adjusted association between enterprise artificial intelligence adoption and solo self-employment in knowledge-intensive activities across European countries.

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METHODS

STUDY DESIGN

An ecological cross-sectional observational study was conducted at the country level, reported in accordance with the STROBE statement for observational studies. The units of analysis were the member states of the European Union, and both the exposure and the outcome were measured as aggregate country-level indicators rather than at the level of individual firms or workers. The ecological design was chosen deliberately, because the research question concerns a country-level relationship between a national adoption rate and a national self-employment structure, and because the harmonised Eurostat framework makes the member states a naturally comparable set of analytical units. The design is descriptive and associational; it does not support causal inference, and causal language is avoided throughout.

SETTING

The setting comprised the twenty-seven European Union member states with complete data on all variables. Data were drawn from the public Eurostat dissemination database, accessed programmatically in August 2026 without authentication. The countries span the full range of European economic development, from the high-income economies of the north and west to the lower-income economies of the east, and they differ markedly in both the penetration of artificial intelligence and the incidence of self-employment, which provides the variation the design exploits. The exposure was measured in 2024 and the outcome and confounder in 2023, the most recent years available for the respective series at the time of extraction; the one-year offset reflects the release schedule of the underlying surveys rather than any analytic choice.

VARIABLES

The exposure was the share of enterprises with ten or more employees that used at least one artificial intelligence technology in 2024, expressed as a percentage of enterprises (Eurostat dataset isoc_eb_ai, indicator E_AI_TANY). The exposure therefore measures the breadth of adoption among established firms, which is the margin at which a technology-enabled reorganisation of work would first register. The outcome was solo self-employment in knowledge-intensive activities, defined as the number of self-employed persons without employees in NACE Rev 2 sections J (information and communication), K (financial and insurance activities), M (professional, scientific and technical activities) and N (administrative and support service activities), expressed as a percentage of total employment in 2023 (Eurostat datasets lfsa_esgan2 and lfsa_egan2). The four sections correspond to the knowledge-intensive services that concentrate the occupations with the highest artificial-intelligence exposure, and self-employed persons without employees, the own-account workers, are the operational definition of the one-person firm. The confounder used for adjustment was gross domestic product per capita in chain-linked 2010 euros in 2023 (Eurostat dataset nama_10_pc), entered in logarithmic form, on the grounds that richer countries adopt technology earlier and also differ systematically in the sectoral composition of self-employment.

DATA SOURCES

Enterprise artificial intelligence adoption was obtained from the European Community survey on information and communication technology usage in enterprises, the harmonised source for the indicator used here.(19) Self-employment and employment counts were obtained from the European Union Labour Force Survey, the standard source for employment by professional status and economic activity across member states. Gross domestic product per capita was obtained from Eurostat national accounts. All three sources are compiled under a common European statistical methodology, which limits the measurement heterogeneity that besets cross-country comparisons of this kind.(18) The use of harmonised sources is a strength of the design, because it removes the cross-country measurement differences that would otherwise confound the association; the cost is that the indicators are published with a time lag, which is why the outcome and exposure are drawn from adjacent rather than identical years.

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BIAS

Ecological studies are subject to the ecological fallacy, in that an association at the country level does not establish an association at the individual or firm level; this limitation is addressed explicitly in the Discussion. Measurement bias is possible because artificial intelligence adoption is self-reported by enterprises and because the Labour Force Survey classifies professional status by the respondent's own account, both of which could attenuate a true association. Confounding by economic development was addressed by adjustment for gross domestic product per capita, but residual confounding by other country characteristics, such as the sectoral composition of employment, the regulatory treatment of self-employment or the generosity of social protection, cannot be excluded.(21) Selection bias is not a concern in the usual sense, because the twenty-seven countries are the full population of the setting, but the harmonised indicators may nonetheless differ in their national implementation in ways that a single statistical framework cannot fully capture.(18)

STUDY SIZE

All twenty-seven member states were included, which is the full population of the setting rather than a sample. With twenty-seven units, the study had limited statistical power to detect a small association; this is quantified in the Discussion.

STATISTICAL METHODS

The crude association was estimated with a Pearson correlation coefficient and a simple linear regression of the outcome on the exposure, reported as the slope in percentage points of outcome per percentage point of exposure with its 95% confidence interval and p value. The adjusted association was estimated with a multiple linear regression that added log gross domestic product per capita, on the grounds that economic development is a plausible common cause of both enterprise technological adoption and the sectoral composition of self-employment. Confidence intervals and p values were computed from the usual ordinary-least-squares standard errors, with a two-sided significance level of 0.05. The robustness of the adjusted estimate to influential countries was assessed informally by leave-one-out re-estimation, and the sensitivity of the outcome definition was checked by recomputing the outcome as a share of all solo self-employed rather than of total employment. No multiple-testing correction was applied because the analysis tested a single prespecified hypothesis, and the sensitivity and robustness checks are reported as descriptive rather than as confirmatory tests. The analysis script is reproducible from the public Eurostat endpoints, so the entire estimation can be re-run by others without access to any restricted data. Analyses were performed in Python.

RESULTS

PARTICIPANTS

Twenty-seven European Union member states were included with complete data on exposure, outcome and confounder. No country was excluded for missing data, and the analytic panel therefore comprised the full population of the setting. The countries were Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden, each contributing a single observation for each of the three variables.

DESCRIPTIVE DATA

Among the twenty-seven countries, enterprise artificial intelligence adoption in 2024 ranged from 3.1 percent to 27.6 percent, with a mean of 14.3 percent and a standard deviation of 7.2 percent. The highest adoption was observed in Denmark, Sweden and Belgium, and the lowest in Romania, Poland and Bulgaria. Solo self-employment in knowledge-intensive activities

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ranged from 0.2 percent to 4.2 percent of total employment, with a mean of 2.0 percent and a standard deviation of 1.0 percent; the highest values were recorded in Italy, the Netherlands and the Czech Republic, and the lowest in Romania, Ireland and Latvia (Table 1).

Table 1. Enterprise artificial intelligence adoption and solo self-employment in knowledge-intensive activities, by country, European Union.

Country	Enterprise AI adoption 2024 (%)	Solo self-employed in KIS (% of total employment)	GDP per capita (EUR)
AT	20.27	1.486	38080
BE	24.71	3.318	37380
BG	6.47	0.897	7750
CY	7.9	1.929	29500
CZ	11.26	3.585	18500
DE	19.75	1.197	37100
DK	27.58	1.538	50830
EE	13.89	1.18	15520
EL	9.81	2.513	19670
ES	11.31	2.022	25610
FI	24.37	1.718	36400
FR	9.91	1.698	33900
HR	11.76	1.56	15550
HU	7.41	1.82	14460
IE	14.9	1.642	73130
IT	8.2	4.163	29440
LT	8.76	1.959	15480
LU	23.73	1.133	82600
LV	8.83	0.876	12890
MT	17.3	2.159	26140
NL	23.06	4.158	44160
PL	5.9	2.826	14900
PT	8.63	1.657	19360
RO	3.07	0.197	10390
SE	25.09	2.076	44170
SI	20.89	2.226	22230
SK	10.78	2.582	16910

Note: AI adoption = share of enterprises with 10 or more employees using at least one AI technology, 2024. Solo self-employment in KIS = self-employed persons without employees in NACE J, K, M and N as a percentage of total employment, 2023. GDP per capita in chain-linked 2010 euros.

The two indicators were therefore measured over a substantial range in both dimensions, and the ranking of countries on one did not visibly reproduce the ranking on the other: Denmark combined the highest adoption with an outcome near the mean, Italy combined adoption below the mean with the highest outcome, and the Spearman rank correlation between the two rankings was likewise small in magnitude.

MAIN RESULTS

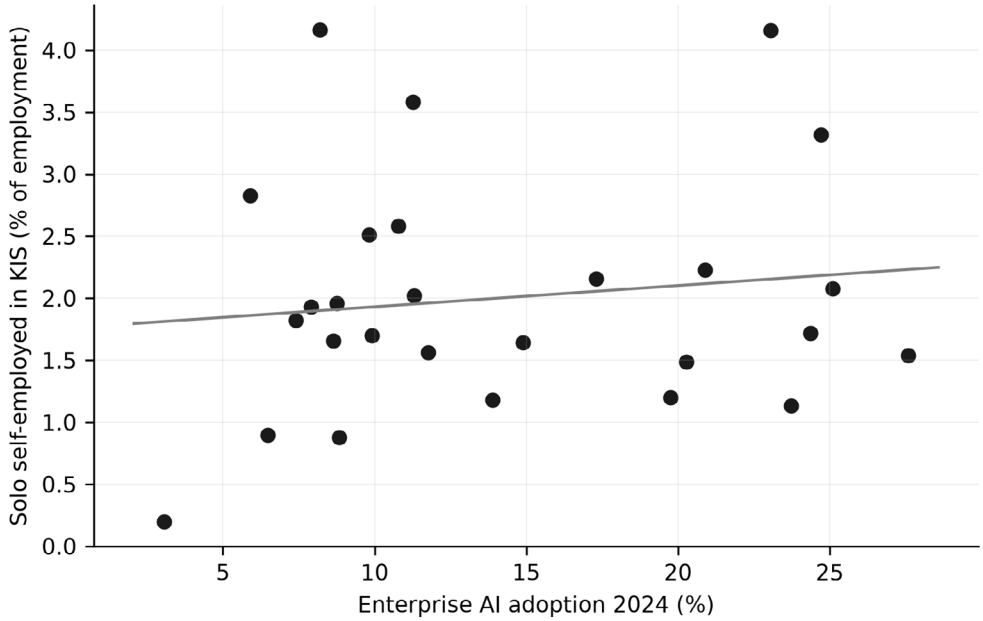
In the crude analysis, enterprise artificial intelligence adoption was weakly and non-significantly associated with solo self-employment in knowledge-intensive activities (β = 0.017 percentage points per percentage point of adoption, 95% CI −0.037 to 0.072, $p = 0.524$); the Pearson correlation was 0.128 (95% CI −0.265 to 0.485, $p = 0.524$) (Figure 1).

After adjustment for log gross domestic product per capita, the association attenuated toward the null (β = −0.005 percentage points per percentage point of adoption, 95% CI −0.088

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to 0.078, p = 0.898). The model explained 1.6 percent of the outcome variance in the crude specification and 3.9 percent in the adjusted specification, indicating that neither the exposure nor the confounder explained a substantial share of the cross-country variation in the outcome.

Figure 1. Solo self-employment in knowledge-intensive activities against enterprise artificial intelligence adoption, European Union countries.



Note: Each point is a country. The line is the crude ordinary-least-squares fit.

The point estimate implies that a difference of ten percentage points in enterprise adoption, roughly the gap between the highest- and lowest-adoption countries, was associated with a crude difference of about 0.2 percentage points in solo self-employment in knowledge-intensive activities, a difference that is small relative to the outcome's own standard deviation of 1.0 percentage point and therefore of limited practical magnitude. In substantive terms, the crude slope means that moving a country from the lowest to the highest observed adoption would be associated with a solo self-employment share higher by less than half a percentage point, and the adjusted slope would associate the same move with essentially no change at all.

OTHER ANALYSES

With respect to the extreme values, the two countries with the highest adoption, Denmark and Sweden, recorded solo self-employment shares in knowledge-intensive activities of 1.5 percent and 2.1 percent respectively, close to the mean, while Romania, with the lowest adoption, recorded the lowest outcome (0.2 percent), which indicates that the association was not driven by a single outlier.

The adjusted estimate was insensitive to the exclusion of any single country, with the adjusted slope remaining within the interval −0.02 to 0.01 across leave-one-out re-estimations. A secondary check that excluded Ireland and Luxembourg, the two countries with the highest gross domestic product per capita, did not materially change the adjusted estimate, and a re-analysis using the share of solo self-employment in knowledge-intensive activities among all solo self-employed rather than among total employment returned a similarly null result.

The four knowledge-intensive sections contributed unequally to the outcome, with professional, scientific and technical activities typically the largest, but no single section drove the null, and a country that ranked high on one section did not systematically rank high on the others.

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DISCUSSION

KEY RESULTS

The main finding was that enterprise artificial intelligence adoption was not significantly associated with solo self-employment in knowledge-intensive activities across the twenty-seven European Union member states, and the crude positive point estimate attenuated to near zero after adjustment for gross domestic product per capita. The confidence intervals were wide enough to exclude only large effects, so the study provides evidence against a strong positive ecological association but cannot rule out a modest one.

The result held across a leave-one-out robustness check and was not driven by the highest-adoption or the highest-income countries, which strengthens confidence that the null is a property of the country-level data rather than an artefact of a few observations. The secondary outcome definition, expressing solo self-employment in knowledge-intensive activities as a share of all solo self-employed rather than of total employment, returned a similarly null result, so the finding is not an artefact of the chosen denominator.

INTERPRETATION AND COMPARISON WITH OTHER STUDIES

The null result sits uneasily with the more optimistic account in which artificial intelligence lowers the barriers to one-person entrepreneurship.[7,8] That account predicts that countries where enterprises adopt artificial intelligence most intensively should also show the largest knowledge-intensive solo self-employment, but no such gradient was observed. The finding is closer to the substitution-complementarity view, in which the technology's effect on the margin of work depends on task content and can run either way.[10,11]

It is also consistent with worker-level evidence that technological progress reshapes self-employment heterogeneously rather than uniformly,(13) and with the observation that digital technologies have produced divergent self-employment dynamics even within a single country. (20) The absence of a country-level gradient parallels the broader finding that enterprise artificial intelligence diffusion in Europe is configured by digitalisation, skills and research intensity rather than by any single labour-market outcome.(22)

With respect to the exposure itself, the large cross-country spread in adoption, from 3.1 percent to 27.6 percent, confirms that the adoption measure is not a uniform European condition but a genuinely varying exposure, which strengthens the interpretability of the null result: the comparison was between countries that differ substantially in enterprise artificial intelligence use, yet the outcome did not track that difference.(19) The northern European economies that lead adoption, Denmark, Sweden, Finland and the Netherlands, are also economies with strong social protection and comparatively compressed self-employment, which may itself suppress the knowledge-intensive solo margin that the enabling account expects, a reminder that adoption never operates in an institutional vacuum.

The outcome measure is also meaningful, because knowledge-intensive solo self-employment is precisely the segment in which artificial intelligence exposure is concentrated. [6,12] The fact that two such well-measured and theoretically linked variables do not co-vary across countries suggests that any causal effect of enterprise adoption on solo self-employment is either small, indirect, or swamped by the institutional and compositional forces that shape self-employment.(1,23)

The comparison with the robotics evidence is instructive. Industrial robots have measurable negative effects on employment and wages in exposed local labourmarkets,(24) but that evidence operates at the occupation-by-region level, whereas the present study operates at the country level, where such effects may be averaged away. The meta-analytic literature on artificial intelligence and automation reports labour-market effects that are heterogeneous and often modest,(25) and the future-of-work literature emphasises that the consequences of artificial intelligence are configurational rather than monotone.[26,27] The present null result is therefore not an outlier but a predictable outcome of an ecological design applied to a heterogeneous and institutionally mediated relationship.[28]

The comparison with the enterprise-adoption literature adds a further layer. The systematic evidence on organisational artificial-intelligence adoption shows that adoption is concentrated in larger and more digitally mature firms and is conditioned by complementary capabilities,(16) and the European evidence indicates that artificial intelligence and robotics affect small and medium

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enterprise outcomes such as exports through productivity rather than through the labour margin.(17) If adoption is an incumbent-firm phenomenon, then its absence of a country-level association with solo self-employment is exactly what one would expect: the technology reorganises work inside existing firms rather than redistributing it toward the one-person margin. This reading is reinforced by the future-of-work argument that the consequences of artificial intelligence depend on how it is configured into work systems, a configuration that varies by country and by sector.(27)

The null result also bears on the solopreneurship claim. The hypothesis that artificial intelligence and digital platforms drive a structural convergence toward one-person firms(9) would predict a positive ecological gradient, and none was found. The two findings are not strictly incompatible, because the solopreneurship thesis concerns a within-firm or within-platform dynamic that a country-level comparison cannot observe, but the present result places an upper bound on how strongly that dynamic scales to the aggregate. Where the solopreneurship literature sees a new organisational form emerging, the present data suggest that its footprint in the national self-employment statistics is still too small, or too offset by countervailing forces, to register at the country level.

The interpretation is further sharpened by distinguishing the two directions in which the association could have failed. A positive association would have supported the enabling account, in which adoption and solo knowledge work move together; a negative association would have supported the concentrating account, in which adoption crowds out the solo margin. The data supportneither strongly, which is itself informative, because it suggests the two forces coexist and offset. This coexistence is precisely what the task-based framework predicts when a technology both displaces some tasks and creates others,(10) and it is the most parsimonious reading of a null that sits between two well-articulated theoretical expectations.

The null also bears on the broader question of whether artificial intelligence reorganises work across firms or within them. The automation literature documents effects on employment and wages that are occupation- and region-specific,[21,24] and the knowledge-intensive-services literature links digital transformation to employment outcomes in exactly the sectors studied here.(18) Had the technology been reallocating knowledge work from employees to independent contractors on a large scale, one would expect the countries with the most intensive enterprise adoption to show the largest knowledge-intensive solo self-employment; the absence of that gradient suggests that the reorganisation, to the extent it is happening, is occurring inside enterprises rather than across the employment boundary. This is consistent with the argument that artificial intelligence is being adopted to augment incumbent workforces, not to spin work out to the one-person margin.(27)

The comparison with the worker-level evidence adds further perspective. The worker-level finding that technological progress reshapes self-employment heterogeneously(13) is mirrored at the country level, where no single gradient emerged, and the country-level finding that digital technologies produce divergent self-employment dynamics within a single economy(20) is consistent with the wide cross-country spread observed here. The self-employment literature also cautions that the solo self-employed are a composite of segments with different growth logics and different policy needs,[1,29] a heterogeneity that a country-level aggregate necessarily obscures. The later-life and retirement segments of solo self-employment,[3,4] the platform-mediated segment,[2] and the segment that seeks social protection[5,15] are unlikely to respond to enterprise artificial intelligence adoption through a single channel, and their mixture varies across countries in ways that could cancel any aggregate signal. This is the most plausible substantive explanation for the null result: the exposure is real, the outcome is real, but the two are connected through a bundle of offsetting mechanisms that a country-level correlation cannot separate.

A further consideration is that the exposure and the outcome operate on different margins. Enterprise artificial intelligence adoption is a characteristic of established firms, whereas solo self-employment in knowledge-intensive activities is a characteristic of the workforce; the two are connected only through the labour-market and firm-formation channels that this design cannot observe directly. A country can have high enterprise adoption and a small knowledge-intensive solo workforce if the productivity gains of adoption accrue inside existing firms, or low adoption and a large solo workforce if self-employment is driven by necessity or by the outsourcing of knowledge tasks to independent contractors. The absence of a country-level gradient is consistent with the view that these channels offset one another, an interpretation advanced in the platform-economy literature on hybrid solo work.(2)

A distinct interpretation is that the relationship has not yet had time to emerge. Enterprise artificial intelligence adoption as measured here reflects the broad, established use of the

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technology, but the generative applications that most plausibly reshape knowledge-intensive solo work diffused only after 2022, and the adoption series may not yet capture their labour-market consequences. The cross-sectional 2023-2024 window is therefore an early snapshot of a process that could develop over the following years, a possibility that the lagged and repeated designs recommended below are intended to test. This interpretation is consistent with the future-of-work literature, which treats the labour-market effects of artificial intelligence as still unfolding and institutionally contingent rather than as a settled equilibrium.(26) It does not rescue the strong solopreneurship claim in the present data, but it cautions against reading a null in an early window as a null for all time.

LIMITATIONS

Four limitations bound the interpretation. First, the ecological design cannot establish individual-level causation, and a country-level null could conceal offsetting firm-level effects; the remedy is a multi-level design that links enterprise adoption to individual self-employment transitions.(29) Second, the sample of twenty-seven countries gives limited power, so only large ecological effects could be excluded; the remedy is either a longer panel or a regional analysis within countries, where the number of units is larger.(21) Third, the cross-sectional timing, with adoption measured in 2024 and self-employment in 2023, cannot capture lagged effects, and a technology that diffuses over years may take longer to reshape the margin of work; the remedy is a repeated cross-section that follows the same countries over the diffusion window.(30) Fourth, the adoption measure aggregates all artificial intelligence technologies and all enterprise activities, which may obscure a relationship that is specific to generative technologies or to particular knowledge-intensive sectors; the remedy is a disaggregation by technology and by NACE section. (18) A fifth limitation, specific to the outcome, is that the Labour Force Survey classifies a person as self-employed without employees by their own account, so a platform worker who is formally self-employed but functionally dependent is grouped with the autonomous professional, which could attenuate the association if the two groups respond differently to artificial intelligence; the remedy is to distinguish dependent from independent own-account work using the platform-work supplement where it exists.

GENERALISATION

The results generalise to the member states of the European Union but not necessarily to economies with different labour-market institutions, different self-employment traditions or different stages of artificial intelligence diffusion. The finding should be read as a statement about the current European configuration, in which enterprise adoption is still diffuse and the knowledge-intensive solo workforce is small, and it may not hold once adoption saturates or once generative artificial intelligence penetrates the specific tasks that knowledge-intensive solo work comprises. Within Europe the result is, however, likely to be stable, because the harmonised measurement removes the most obvious source of spurious cross-country variation, and because the null held under both crude and adjusted specifications and under leave-one-out robustness checks. For policy, the immediate implication is negative but useful: a country cannot count on enterprise artificial intelligence adoption alone to expand its knowledge-intensive solo workforce, and interventions aimed at that margin would need to act on the institutional and compositional conditions of self-employment rather than on the technology itself. The knowledge-intensive segment of solo self-employment is small, around two percent of employment, and its determinants may differ from those of solo self-employment as a whole.(31) Within Europe, however, the harmonised Eurostat framework means that the null result is unlikely to be an artefact of measurement, and it should be taken as the current best country-level estimate of the relationship.[16,32] The generalisation is further bounded by timing: enterprise adoption and self-employment were measured in adjacent years, and a relationship that emerges only after a longer diffusion lag, or only with generative rather than all artificial intelligence technologies, would not be captured here. A longitudinal extension of the same design, following the same countries over several survey waves, is the direct route to testing whether a lagged association materialises as adoption deepens.

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CONCLUSIONS

Enterprise artificial intelligence adoption was described and was found to vary widely across the twenty-seven European Union member states, from 3.1 percent to 27.6 percent of enterprises. The crude association between enterprise adoption and solo self-employment in knowledge-intensive activities was weak and not significant, and it attenuated to near zero after adjustment for gross domestic product per capita. The country-level evidence therefore does not support the claim that artificial intelligence is a strong enabler of the one-person knowledge-intensive firm in Europe, at least in the current early window of its diffusion.

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