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Painting the whole picture: Connecting new business formation, innovative entrepreneurship, and entrepreneurial ecosystems with unemployment

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ABSTRACT
The connection between business formation and unemployment has been a topic of discussion in the scientific literature for decades. As time progressed, new insights emerged from the increased utilization of methodological complexities. Nonetheless, a gap remains in how innovative entrepreneurs respond to changes in unemployment and vice versa. Similarly, there is scarce evidence of the relationship between entrepreneurial ecosystems and unemployment. To resolve these gaps, data are collected at the regional level, and the results of three panel vector autoregression models reveal no reverse causality between new business formation, innovative entrepreneurship, and entrepreneurial ecosystems on the one hand and unemployment on the other. They do, however, support two direct relations. One, new business formation negatively impacts unemployment. Second, unemployment is a negative antecedent of innovative entrepreneurship. Unexpectedly, the entrepreneurial ecosystem's autoregressive coefficient is negative. These findings are situated within robust explanatory frameworks. Accordingly, the outcomes of this study can be used by a broad and diverse set of regional policymakers to devise strategies for regional development.

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1. Introduction

In almost every country in the world, you will find a news outlet publishing a piece of writing that highlights and underscores the importance of entrepreneurship in regional development. Policymakers also continually present a narrative of entrepreneurship, particularly the innovative type, as one of the keys not only to citizens' autonomy but also to the community's overall wealth accumulation. It is reasonable to ask where the information for this narrative comes from. It can be said that, for well over three decades (Fritsch & Storey, 2014), entrepreneurship and regional development are inextricably linked and mutually beneficial concepts in the scientific literature. However, the truth is that this link is much more complex than one might get the impression of without delving deeper into the literature.

For one, different authors mean different things by entrepreneurship and regional development. Primarily, but not exclusively, entrepreneurship is characterised by the formation of new businesses. Unlike entrepreneurship, regional development is measured in various ways, ranging from gross domestic product to unemployment (Müller, 2016). This paper focuses on the unemployment aspect of regional development. From an entrepreneurial perspective, the conceptualisation of entrepreneurship is expanded to include innovative ventures and regional entrepreneurial ecosystems alongside new business formation.

Second, narrowing the focus to the relationship between entrepreneurship and unemployment in the literature reveals a trend in methodological approaches. Researchers moved from more straightforward to more complex models, revealing, in the process, more elaborate findings. When papers began to be published in bulk, a common modelling approach was to either test solely the direct linear impact of the establishment of new businesses on the unemployment rate in one study and the reversal of this influence in another (for an overview, see Müller, 2016). Once more data became available, studies branched into a couple of directions. First, some authors have employed a nonlinear modelling approach, distinguishing between short- and long-term effects (e.g., Mueller et al., 2008). Second, albeit less frequently utilised, other authors examine reverse causality in a single model, thereby obtaining a more nuanced picture (e.g., Dohse & Vaona, 2018). From the implications side of the equation, in short, when a study used the levels of new businesses as a predictor of unemployment, the debate centred on why and when the impact occurs, while also attempting to explain the mixed findings of previous studies. Alternatively, when a study used unemployment as a predictor of new business levels, a now well-known push-pull debate emerged.

All of the specified approaches are of high merit and rigour. While they disclosed many valuable insights, there are, nonetheless, still unresolved issues. For one, the specific type of new businesses is not accounted for. It stands to reason that more innovative new businesses would be more likely to experience unemployment effects differently than their less innovative counterparts. The opportunity-necessity classification is the closest model setup for controlling innovative potential (e.g., Crecente-Romero et al., 2019; Nikolaev et al., 2018). Still, data availability, amongst other things, prevents more elaborate and robust statistical frameworks from being utilised. Secondly, a few studies to date have examined entrepreneurial ecosystems – specifically, the labour market link (Iacobucci & Perugini, 2021; Szerb et al., 2019)- and, when they did, their models lacked methodological complexity. The reason for this omission is the relatively recent emergence of the entrepreneurial ecosystem concept (Stam, 2015) and, again, the unavailability of data. Accordingly, the relationship between entrepreneurial ecosystems and unemployment is on equal footing, as was the relationship between new business formation and unemployment a few decades ago.

While this was not previously the case, data is now accessible to close the noted research gaps, which is the aim of this study. A novel database, the Startup Cartography Project (Andrews et al., 2022), enables researchers to access a large panel dataset that encompasses not only the rate of new business establishments but also levels of innovative entrepreneurship and the quality of the entrepreneurial ecosystem. These three variables are incorporated into three separate panel vector autoregression (PVAR) models in which the dynamic relationship with the unemployment rate is assessed. In conjunc-

tion with PVAR estimates, Granger causality tests (GCTs), orthogonal impulse response functions (OIRFs), and forecast error variance decompositions (FEVDs) are presented. At the county level in the United States of America, across models with temporal dimensions of 23 and 2396 spatial units, the PVAR calculations reveal no reverse causality in any of the three models. Nevertheless, significant cross-relations exist for new business formation and innovative entrepreneurship. New business formation is a negative predictor of unemployment. Regarding the relationship between innovative entrepreneurship and the unemployment rate, the latter negatively affects the former. Furthermore, the supplementary analysis revealed a low response to external shocks for all four variables of interest. What these four variables have in common is their dependence, to varying degrees, on their previous or historical values.

The contributions of this paper are threefold. First, when mutually interpreted, the models offer a parsimonious explanation of the regional entrepreneurship–unemployment nexus. Within a single framework, the models help resolve the push-pull debate while avoiding heterogeneity across units, as is customary in cross-national data models (Thurik et al., 2008). Second, it responds to a long-lasting call from Gohmann and Fernandez (2014) to incorporate entrepreneurial quality and quantity in a PVAR setup. Third, a recent debate has emerged on whether the persistence of quality entrepreneurship at the regional level is present in modern economies (Coad et al., 2025; Coad & Srhoj, 2023; Van Dijk et al., 2025). Here, there are indications that innovative entrepreneurship prevails over time. What was not in the debate was the persistence of entrepreneurial ecosystems themselves. Intriguingly, results reveal negative autoregressive effects. Hence, the theoretical postulates of an emerging ecosystem concept are both advanced and questioned.

2. Literature review

2.1. New business formation, innovative entrepreneurship, and unemployment

Research on the relationship between entrepreneurship and the labour market, typically measured by unemployment rates, is extensive and fruitful. Over many decades of applying different methodological approaches across diverse geographical contexts, much has been said about the relationship between entrepreneurship and unemployment (Gupta, 2024). At this point, it is worth noting that it is customary to define entrepreneurship as the act of founding a new business and to use the region's standard unemployment rate. Overall, from a modelling perspective, two broad streams of research dominate the publication landscape. One stream examines how entrepreneurship affects unemployment, while the other examines how unemployment affects entrepreneurship.

The most common and straightforward approach to investigating the relationship between entrepreneurship and unemployment is through a direct effect. In other words, there is a linear, straight, causal path from entrepreneurship to unemployment. In her 2016 review paper, Müller found examples of regional entrepreneurship that benefit the regional labour market, interpreting this as a need for new businesses to support the regional labour force. Baumgartner et al. (2013) review supports Müller's (2016) views, with a caveat that regional entrepreneurial effects are contingent on how one conceptualises entrepreneurship. More on that topic later on. Contemporary research mainly strengthens what was previously discovered. For instance, Komninos et al. (2024) demonstrate the value of new business formation in enhancing regional employment opportunities.

A different state of the field is found with the opposite effect. Many studies have sustained the notion that unemployment is causally prior to entrepreneurship. Two antithetical findings are often juxtaposed and jointly explained. One is the "push" effect, whereby an increase in unemployment triggers an increase in new business establishments. From a labour market perspective, the reasoning is that when faced with a lack of employment options, individuals often choose entrepreneurship as a solution to a cash flow crunch. More specifically, individuals opt for entrepreneurship as a career choice since the opportunity cost of founding a venture is lowered, the attainability of capital goods is increased, and the non-financial aspect of being an entrepreneur is more

pronounced (see Gohmann & Fernandez (2014) and Haussen & Schlegel (2020) for more details). The other effect is the "pull" effect. Here, an increase in new business results from a decrease in the unemployment rate. Individuals view economic conditions as favourable for achieving the benefits of entrepreneurship. They do so because when in a prosperous economic environment, there are more business opportunities due to an increase in market demand, more credit lines available, and more income is accrued for covering fixed costs in establishing a business (again, for a lively discussion, see Gohmann & Fernandez (2014) and Haussen & Schlegel (2020)). Overall, Müller's (2016) review finds the evidence inconclusive. As time progressed, contemporaneous studies did not resolve this debate (e.g., Horta et al., 2016; Hou et al., 2025; Martiarena, 2020; Novejarque Civera et al., 2021; Patel & Devaraj, 2022; Pisá-Bó et al., 2021; Tsvetkova & Partridge, 2021).

Some authors challenge the use of direct linear models. They say that entrepreneurship and unemployment are related in a more complex way, a relationship that traditional approaches cannot capture. These authors accomplish this goal in three prominent ways: nonlinear modelling, bi-directional causality, and business demarcation.

Nonlinear models often examined the impact of entrepreneurship on unemployment, with special attention to time effects modelled using polynomials. In two highly acclaimed papers, Mueller et al. (2008) and Fritsch (2008) laid a strong foundation for the wave pattern. According to the wave pattern, changes in unemployment stemming from entrepreneurship are reflected in three phases. In phase one, called direct effect (Mueller et al., 2008) or new capacities (Fritsch, 2008), new businesses entering the market, basically by definition, require workers and should attract individuals who, at that time, are the unemployed part of the labour force. The changes this effect brings to the market are felt very quickly and, in general, should reduce unemployment in the short term. However, other subtler effects appear afterwards. In phase two, known as the displacement effect (Mueller et al., 2008) or exit of less productive firms (Fritsch, 2008), new-coming firms displace less productive firms from the market. The remaining business landscape should be more efficient, thus reducing the need for workers. Accordingly, the unemployment rate actually rises in the medium term. Following phase two, in phase three, the induced effect (Mueller et al., 2008) or supply-side effects (Fritsch, 2008), the arrow of influence again switches, making the effect of new firms on unemployment negative. As market competition intensifies, more product offerings and structural changes are introduced, resulting in longer-lasting efficiencies and greater market share. The evidence for this wave model is robust to changing contexts. As summarised by Fritsch (2008), most authors found strong evidence for the three initially postulated phases within a single-country regional framework. Recent examples add further credence to the wave model (e.g., Kachlami et al., 2021).

Bi-directional modelling further explores the issue by testing for reverse causality using the PVAR method. The reported outcomes are, to an extent, congruent in that reverse causality depends on how authors frame the entrepreneurship variable. For instance, Dohse and Vaona (2018) and Koellinger and Thurik (2012) find no evidence of reverse causality between entrepreneurship and unemployment. Yet, Wosiek et al. (2022) find similar results, except for a few industries. Additionally, Gohmann and Fernandez (2014) suggest bi-directional causality when entrepreneurship is defined as the establishment of new businesses, but not when it is defined as a sole proprietorship.

Rather than employing more complex statistical methods, another approach for probing the relationship between entrepreneurship and unemployment is to highlight the multifaceted nature of entrepreneurship. Not all businesses are created equal. If combined, differing business qualities could potentially present an inaccurate picture of the evolving micro-level dynamics. While several lines of inquiry exist, e.g., differentiation on niche market share (Benz et al., 2024), most authors who take this route customarily differentiate between two types of entrepreneurship: opportunity and necessity. Using the standard description by Reynolds et al. (2005), opportunity entrepreneurs found ventures when they discovered a Kirznerian entrepreneurial opportunity,

while necessity entrepreneurs found ventures as a result of lacking other options. The opportunity-necessity divide can be interpreted as materialisation and direct observation of one aspect in the push-pull debate. When incorporated into linear models, the results on opportunity-necessity entrepreneurship reveal interesting insights.

For instance, the overall economic environment does constrain the space for founding and managing opportunity and necessity firms (Crecente-Romero et al., 2019; Omri et al., 2024). More specifically, the effect of unemployment on opportunity can be both negative and non-significant (Bergmann & Sternberg, 2007; Content et al., 2019; Nikolaev et al., 2018) while being both a positive and non-significant precursor to necessity entrepreneurship (Bergmann & Sternberg, 2007; Content et al., 2019; Ferrín, 2023; Nikolaev et al., 2018). Far less is known about treating opportunity and necessity as explanatory factors at the meso or macro scale. A notable exception is the paper by Mrożewski and Kratzer (2017), who connect opportunity entrepreneurship with country-level technological progress and, by contrast, necessity entrepreneurship with the lack thereof. It is also worth noting that, even when this distinction is not made explicitly, there are instances in the literature where the opportunity-necessity classification is used implicitly as an interpretative framework for the results (Fossen, 2021; Pisá-Bó et al., 2021).

The opportunity-necessity research avenue has its deficiencies. For one, dividing entrepreneurs into two distinct categories might be overly simplistic. Studying self-employed entities, De Vries et al. (2020) find positive effects of necessity-categorised entrepreneurs on turnover rates, from which they deduce that the partitioning of entrepreneurs into either opportunity or necessity categories is more ambiguous than earlier models suggested. Second, the data for most opportunity-necessity empirical models comes from the Global Entrepreneurship Monitor project. Their data spans a diverse set of countries. However, the time component is insufficient for constructing a standard time-series model. Also, missing values further restrict the methodological options. One option is to use correlation analyses to supplement the primary model as a robustness check (Koellinger & Thurik, 2012). Third, the opportunity-necessity classification is primarily based on the background motivation for starting a business rather than on how a business operates or what it produces. It must be acknowledged that the performance of opportunity entrepreneurs is superior to that of necessity entrepreneurs (Caliendo et al., 2023). Nevertheless, necessity entrepreneurs possess the required entrepreneurial skill set (Mühlböck et al., 2018), an attribute that is rarely postulated. Chung et al. (2024) make this point by linking the necessity of entrepreneurship to the concept of disruptive innovation.

From the opportunity-necessity perspective, numerous studies have expanded our understanding of the relationship between entrepreneurship and unemployment. However, the divide might be too restrictive, the data too scarce, and the effects too murky. The Andrews et al. (2022) database overcomes all three concerns. It is designed to alleviate common pitfalls of traditional measures of entrepreneurial activity and to provide additional entrepreneurial statistics not captured by commonly used databases. Andrews et al. (2022) enrich the well-utilised business founding data with predictive analytics on business registration, innovation, and industry characteristics. One important variable here is the continuous quality measure of businesses that consistently extend across multiple periods and geographical regions. Thus, this data can be utilised as a bridge between reverse causality and quality classification models.

2.2. Entrepreneurial ecosystems and unemployment

Compared to the regional entrepreneurial concepts mentioned, the association between entrepreneurial ecosystems and unemployment is far less understood. The standard conceptualisation of an entrepreneurial ecosystem is that of mutually coexisting and codependent stakeholders who, by their interactive dynamics, constitute an environment conducive to highly productive entrepreneurs (Stam, 2015). The most common scholarly interpretation of entrepreneurial ecosystems is the emerging regional web of ten elements: formal institutions, en-

trepreneurship culture, networks, physical infrastructure, finance, leadership, talent, new knowledge, demand, and intermediate services (Stam, 2015; Stam & Van De Ven, 2021). In regionally idiosyncratic ways, these elements form the basis for productive entrepreneurship, a precursor for regional aggregated economic value (Stam, 2015). What that economic value concretely is remains theoretically unspecified.

However, what is clear is the indirect effect of regional entrepreneurial ecosystems on regional economic performance through the productive entrepreneurship channel. The need for contemporaneous data on all ten elements, combined with the mediation feature, is the primary reason why only two studies on this topic have been published to date. Both Iacobucci and Perugini (2021) and Szerb et al. (2019) dispense with the mediation assumption by persuasively arguing for a direct effect of the entrepreneurial ecosystem on regional performance. Iacobucci and Perugini (2021) built on the systemic notion of entrepreneurial ecosystems, arguing that advanced entrepreneurial ecosystems can increase entrepreneurs' resilience, as measured by added economic value and employment levels, during global and national adverse economic conditions. Szerb et al. (2019) stated and tested the proposition that entrepreneurial ecosystems and regional performance are so inextricably linked that a mediating mechanism is unnecessary. Like Iacobucci and Perugini (2021), Szerb et al. (2019) found entrepreneurial ecosystems advantageous for regional economic added value and employment. Both studies, however, share a common yet understandable methodological drawback: they have a limited spatial component and no explicit temporal component, making their models susceptible to criticism when making causal claims.

There is essentially silence in the literature on the reversal effect of economic performance on the entrepreneurial ecosystem. Again, the absence of studies could be explained by a lack of suitable data rather than a lack of potential argumentation. Prior research has shown that unemployment affects distinct components of the entrepreneurial ecosystem, underscoring the need for systemic change. First, an individual's personality, approximated by the Big Five model, is altered when he/she becomes unemployed (Boyce et al., 2015). When unemployment occurs on a larger scale, it can shift the region's entrepreneurial culture, as personality alterations are associated with entrepreneurial dynamics (Runst & Thomä, 2023). Second, unemployment is a direct (Bellmann et al., 2018) and indirect, via industrial specialisation (Ezcurra, 2011), determinant of the heterogeneous dispersion of regional innovation knowledge (Ascani et al., 2020). Third, unemployment can influence the demand aspect of entrepreneurial ecosystems via wages (Bhattarai, 2016). Fourth, regional talent, especially young workers (Bonnet & Murtin, 2024), is also affected by unemployment.

To reiterate, these four factors form a conceptual grounding for the postulated effect of unemployment on entrepreneurial ecosystems. The point here is to propose ways in which unemployment could alter the entrepreneurial ecosystem landscape rather than preemptively postulating whether this effect is positive or negative. Such a task is problematic, as many elements of the entrepreneurial ecosystem are influenced by unemployment. Additionally, as it stands, no theoretical justification has been found for incorporating the previously described wave pattern into the entrepreneurial ecosystem framework. Thus, the results of the three models may be empirically equivalent, yet they do not share a joint conceptual interpretation.

Again, the Andrews et al. (2022) database serves as the primary source of resolution for the aforementioned issues. Andrews et al. (2022) published yearly, region-specific data on the performance of entrepreneurial ecosystems, specifically their ability to transform entrepreneurial potential into actualised firm growth. It therefore enables the construction of a bidirectional model in which the entrepreneurial ecosystem is the variable of interest.

3. Research methodology

The county-level dataset for the United States of America is compiled from two main sources. The first data source is the Startup Cartography Project (Andrews et al., 2022). Three entrepreneurial mea-

sures are collected from the Startup Cartography Project website. They are the Startup Formation Rate (the number of for-profit ventures founded), the Entrepreneurial Quality Index (the average growth potential of ventures around the time they are founded), and the Regional Entrepreneurship Acceleration Index (a measure of the quality of the entrepreneurial ecosystem). In this paper, to align with the previously used nomenclature, the Startup Formation Rate, the Entrepreneurial Quality Index, and the Regional Entrepreneurship Acceleration Index are denoted as NBF, IEI, and QEE, respectively. Following Andrews et al. (2022), NBF is used in subsequent analysis on a per capita basis, while the IEI and QEE remain intact.

The primary data source for non-entrepreneurial variables is the United States Census Bureau. The unemployment rate, defined as the ratio of the unemployed to the labour force, is available on their website. Additionally, the United States Census Bureau serves as the source for two control variables: real median household income per capita and population density. These non-entrepreneurial variables (unemployment rate, real median household income, and population density) are labelled UNR, RHI, and PD, respectively.

Once the data extraction was complete, the data matching began. The data are aligned to obtain a balanced panel dataset. Starting from the Startup Cartography Project data, the dataset is shortened because some QEE values are missing for specific periods associated with NBF and IEI. This fact conditioned the time frame from 1990 until 2012. Next, using the Federal Information Processing Standard State Codes, the county values from the Startup Cartography Project and the United States Census Bureau are matched. Accordingly, counties that appeared in the Startup Cartography Project data but were not in the United States Census Bureau data, and vice versa, have been excluded from further inquiry. As a result, the final analysis includes 2396 counties.

The chosen statistical method for examining the previously explained relationship between entrepreneurship and unemployment is PVAR. PVAR is a commonly used method for testing reverse causality. In this paper, the Least Squares Dummy Variable (LSDV) PVAR is estimated. LSDV is commonly juxtaposed with another prevalent estimator, the Generalised Method of Moments (GMM). When analysing the methodologically oriented literature, it becomes clear that many authors have argued for and against the use of both estimators. Nickell's (1981) famous critique of the LSDV estimator is regularly cited by authors who opt for the GMM estimator in their models. However, the bias of the LSDV estimator depends on the sampled period. Indeed, the larger the period, the lower the bias.

This stipulation is confirmed by Judson and Owen (1999). They conclude that the LSDV estimator is suitable for models with a period of around 20 and that LSDV is comparable to the GMM estimator. Thus, the Judson and Owen (1999) results effectively remove the barriers to using the LSDV in an empirical setting corresponding to the one orchestrated in this paper.

A couple of points are also worth mentioning as a preface to the empirical results. First, values pertinent to stationarity of all variables and stability of all models are computed to ensure the validity of PVAR estimates. Second, the variables are standardised, as significant discrepancies in scale can detract from the readability of the results. Third, a one-lag PVAR model is adopted for two reasons. The first is that it is a common practice in the entrepreneurship literature (e.g., Cebula et al., 2020), and second, and more importantly, adding more parameters to models with an already moderate time frame could cause validity issues. Fourth, as recommended by Gohmann and Fernandez (2014), annual fixed effects are included to account for yearly policy changes. The possibility of applying this feature in a PVAR model is an advantage of using a single-country dataset (Gohmann & Fernandez, 2014). Fifth, as is routinely reported in the literature, PVAR models are complemented with GCTs, OIRFs, and FEVDs.

4. Results

Table 1 displays the PVAR results of three models. In the first model, the cross-lag effect of UNR (t-

1) on NBF (β= -0.004, p>0.05) is not significant, while the opposite, NBF (t-1) on UNR (β= -0.009, p<0.05), is negative and significant. The autoregressive effects of NBF (t-1) on NBF (β= 0.768, p<0.01) and of UNR (t-1) on UNR (β= 0.745, p<0.01) are positive and significant. In the second model, there is also one influential cross-lag effect; the effect of UNR (t-1) on IEI (β=-0.023, p<0.01) is negative and significant. On the other hand, the influence of IEI (t-1) on UNR (β=-0.001, p>0.05) is not significant. The autoregressive effects, i.e., IEI (t-1) on IEI (β= 0.050, p<0.01) and of UNR (t-1) on UNR (β= 0.745, p<0.01), remain positive and significant.

In the third model, the autoregressive relationships switch. While the influence of UNR (t-1) on UNR (β= 0.745, p<0.01) is positive and significant, the outcome of QEE (t-1) on QEE (β= -0.042, p<0.01) is negative and significant. Compared to the first two, discrepancies in the third model continue when examining the cross-lag effects. Here, both the effects of QEE (t-1) on UNR (β= -0.002, p>0.05) and of UNR (t-1) on QEE (β= -0.003, p>0.05) are not significant.

The Wald statistics in Table 2 are aligned with the significance levels of models in Table 1.

Table 1
Panel vector autoregression results

	NBF-UNR		IEI-UNR		QEE-UNR	
	NBF	UNR	IEI	UNR	QEE	UNR
NBF (t-1)	0.768*** (0.003)	-0.009** (0.003)	-	-	-	-
IEI (t-1)	-	-	0.050*** (0.004)	-0.001 (0.002)	-	-
QEE (t-1)	-	-	-	-	-0.042*** (0.004)	-0.002 (0.001)
UNR (t-1)	-0.004 (0.003)	0.745*** (0.003)	-0.023*** (0.006)	0.745*** (0.003)	-0.003 (0.009)	0.745*** (0.003)
RHI (t-1)	0.099*** (0.005)	-0.040*** (0.005)	0.008 (0.010)	-0.043*** (0.005)	-0.002 (0.016)	-0.043*** (0.005)
PD (t-1)	0.198*** (0.040)	0.168*** (0.042)	-0.125 (0.081)	0.156*** (0.041)	-0.121 (0.127)	0.156*** (0.041)
T	23		23		23	
N	2396		2396		2396	

Note. NBF – new business formation per capita; IEI – Innovative entrepreneurship index; QEE – Quality of entrepreneurial ecosystem; UNR – unemployment rate; RHI – real median income per capita; PD – population density; T – number of periods; N – number of panels.
Note. *** means significant at 1% level, ** means significant at 5% level, standard errors in parentheses.
Note: stability in all models is supported since eigenvalues fall within the unit circle.
Note: all six variables are stationary on a 1% level per Levin-Lin-Chu and Harris–Tzavalis tests.

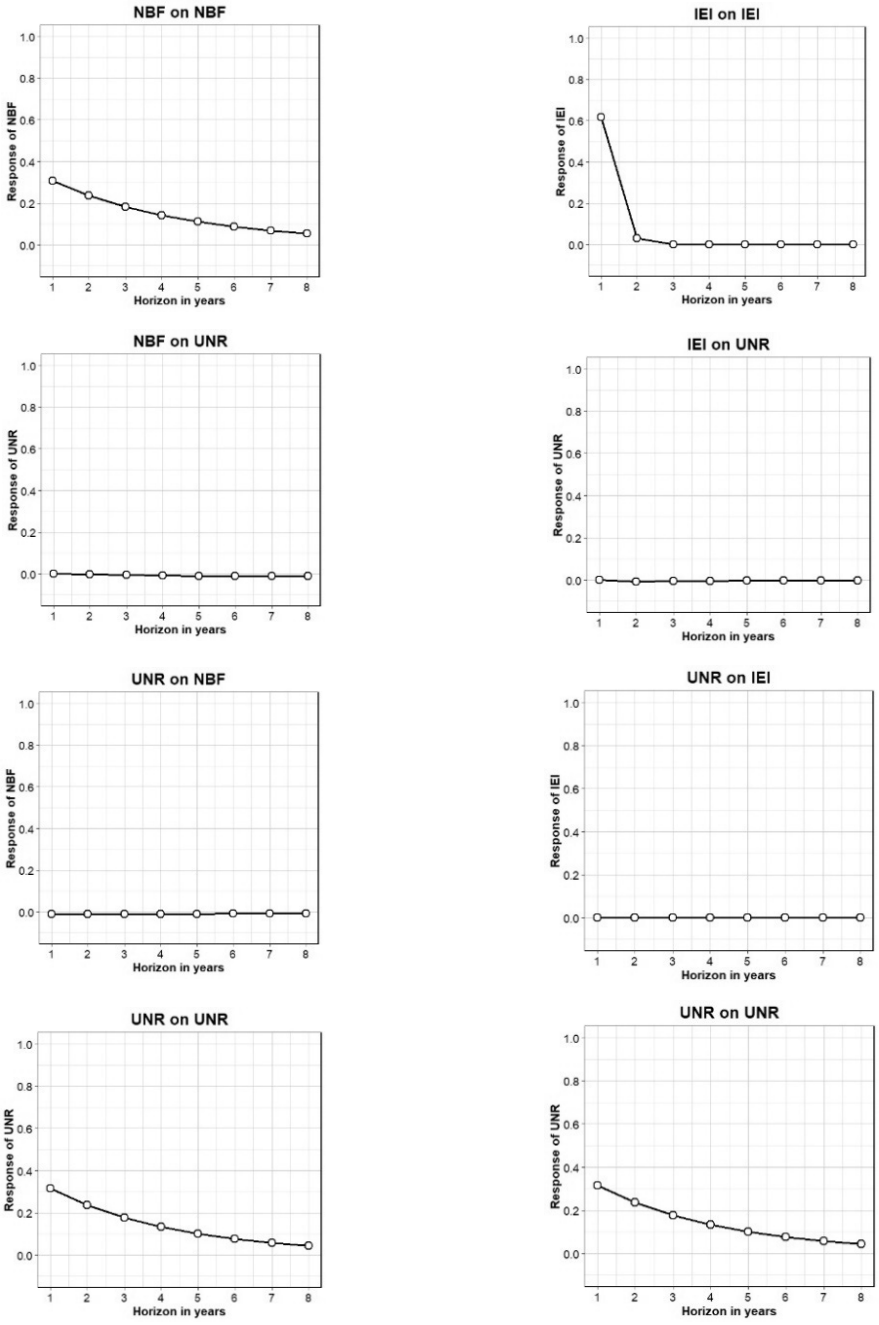
Table 2
Granger causality tests

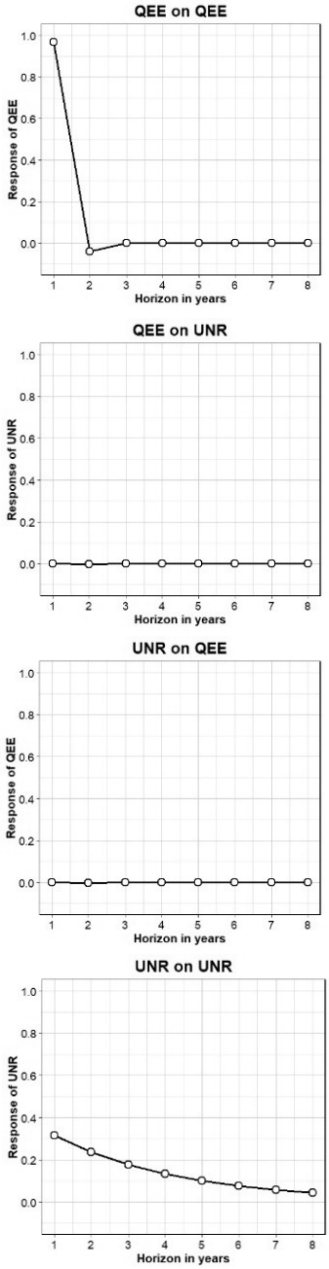
Predictor	Outcome	Wald statistic
NBF (t-1)	UNR	6.607**
UNR (t-1)	NBF	1.866
IEI (t-1)	UNR	0.150
UNR (t-1)	IEI	35.250***
QEE (t-1)	UNR	1.561
UNR (t-1)	QEE	0.121

Note. NBF – new business formation per capita; IEI – Innovative entrepreneurship index; QEE – Quality of entrepreneurial ecosystem; UNR – unemployment rate.
Note. *** means significant at 1% level, ** means significant at 5% level, standard errors in parentheses.

The OIRFs, presented in Figure 1, provide further insights into the examined relationships. In the NBF-UNR model, the two autoregressive effects are downward-sloping, indicating a gradual fading of the initial shocks. However, the shocks are much less felt in the cross-lag effects. The OIRFs for UNR on NBF and for NBF on UNR are essentially flat. As for the second and third models, the patterns of OIRFs are analogous. The autoregressive OIRFs, relating to IEI and QEE, have a sudden drop in the second period, after which they remain flat. The flatness of OIRF is highly pronounced for the remaining four cross-lag relationships. Unsurprisingly, the OIRFs of UNR autoregressive effects in the second and third models are highly comparable to those of the first.

Figure 1
Orthogonal impulse response functions





Note. NBF – new business formation per capita; IEI – Innovative entrepreneurship index; QEE – Quality of entrepreneurial ecosystem; UNR – unemployment rate

The values of FEVDs shown in Table 3 convey a similar message for all three models. Specifically, the forecast variations are predominantly influenced by autoregressive effects, while the cross-lag effects are negligible.

Table 3

Forecast error variance decompositions

NBF-UNR	**NBF**		**UNR**	
	NBF	UNR	NBF	UNR
1	1	0	0.001	0.998
2	0.998	0.001	0.001	0.998
3	0.994	0.001	0.002	0.997
4	0.989	0.001	0.002	0.996
5	0.983	0.001	0.002	0.994
6	0.977	0.001	0.003	0.993
7	0.972	0.001	0.003	0.992
8	0.967	0.001	0.003	0.991
IEI-UNR	**IEI**		**UNR**	
	IEI	UNR	IEI	UNR
1	1	0	0.001	0.999
2	0.999	0.001	0.001	0.999
3	0.999	0.001	0.001	0.999
4	0.999	0.001	0.001	0.998
5	0.999	0.001	0.001	0.997
6	0.999	0.001	0.001	0.996
7	0.999	0.001	0.001	0.995
8	0.999	0.001	0.001	0.994
QEE-UNR	**QEE**		**UNR**	
	QEE	UNR	QEE	UNR
1	1	0	0.001	0.999
2	0.999	0.001	0.001	0.999
3	0.999	0.001	0.001	0.999
4	0.999	0.001	0.001	0.998
5	0.999	0.001	0.001	0.997
6	0.999	0.001	0.001	0.996
7	0.999	0.001	0.001	0.995
8	0.999	0.001	0.001	0.994

Note. NBF – new business formation per capita; IEI – Innovative entrepreneurship index; QEE – Quality of entrepreneurial ecosystem; UNR – unemployment rate.

5. Discussion

The results of this study convey a consistent yet complex picture of the relationship between entrepreneurship and unemployment. Namely, how regional entrepreneurial activity is conceptualised will

determine how it is viewed in relation to unemployment.

If by regional entrepreneurial activity one means the rate of new business establishments, the bidirectional association is absent. Establishing new businesses has a negative impact on unemployment, whereas unemployment is not a significant predictor of new business formation. If by regional entrepreneurial activity, one means the innovative qualities of startups, the bidirectional association is again absent, but in a different way. Innovative startups do not directly impact unemployment rates, while lower unemployment rates can lead to the emergence of more innovative startups.

From the perspective of the entrepreneurship-unemployment link, the results seem counterintuitive. How can overall business formation be more impactful for the labour market than innovative businesses? The wave model provides an answer. In a standard wave pattern, there is a question of when the direct (new capacities) and displacement (exiting capacities) effects cancel out, making the net effect on unemployment insignificant. Usually, they cancel in the short term (Mueller et al., 2008). Nonetheless, it is highly plausible that their intersection depends on time and the types of business involved. By nature, innovative businesses are more conducive and effective for generating positive market trends. Therefore, in the short term, although new business formation might appear more advantageous, innovative businesses expedite the induced effect on unemployment. In other words, the desired long-term horizon appears more quickly.

Regarding the unemployment-entrepreneurship link, in short, neither standard "push" nor "pull" reasons for entering the entrepreneurial arena prevail for new business formation. On the other hand, the traditional "pull" effect is in place for innovative entrepreneurs. Thus, in the same data frame, there is a presence of "pull" and an absence of "push" conditions. In this way, a concise explanation is provided for the numerous previous mixed findings regarding the "pull" and "push" conditions. It is context-dependent. Not geographically but entrepreneurially.

Analogously, if by regional entrepreneurial activity, one means the transformative qualities of stakeholders involved in the regional entrepreneurial environment, there is no reverse causality. Put differently, the quality of a regional entrepreneurial ecosystem does not directly impact unemployment, nor does unemployment directly impact the quality of a regional entrepreneurial ecosystem. On first reading, the empirical results pose a potential challenge to the theoretically developed (Leendertse et al., 2022; Stam & Van De Ven, 2021) and, to an extent, empirically tested (Iacobucci & Perugini, 2021; Szerb et al., 2019) entrepreneurial ecosystem model since, in such models, regional entrepreneurial ecosystems and regional economic outcomes are linked. However, this interpretation is not straightforward on closer inspection for two reasons. First, though the influence of economic outcomes on entrepreneurial ecosystems is direct in the theoretical models, the impact of entrepreneurial ecosystems on economic outcomes can also be indirect through productive entrepreneurship. Second, the economic outcomes in the entrepreneurial ecosystem model are not strictly defined.

Therefore, a theoretical resolution is to highlight the multitude of economic outcomes at the regional level, which, when aggregated into a bundled index, exhibit a positive, bidirectional association with the entrepreneurial ecosystem. What is potentially equally interesting is the negative impact of the entrepreneurial ecosystem on itself, which is discussed next.

Notwithstanding the presented empirical evidence of causality, further analysis reveals that the values at a single time point in all four variables are primarily dominated by their previous values. In essence, the shocks to all four variables are of small magnitude. In more extreme cases, such as innovative entrepreneurship and entrepreneurial ecosystems, the shocks within the internal dynamics tend to fade only after two periods. Similarly, the amount of variance explained by values other than internal ones is minimal. These features are especially relevant to the theoretical development and postulates of entrepreneurial ecosystems, as the persistence of quality entrepreneurship is a consequence of entrepreneurial ecosystem theorising.

Recent empirical evidence on the persistence of quality entrepreneurship is mixed. The results of this paper could be interpreted as providing support for those who claim that, at least, a specific type of entrepreneurial quality persists over time (Coad et al., 2025; Van Dijk et al., 2025). What also prevails in time is the entrepreneurial ecosystem itself. However, an unexpected result is the negative autoregressive effect. Currently, no theoretical model has anticipated this characteristic. One viable interpretation of this oversight lies in the possible underestimation of the resources required to maintain high-performing ecosystems. Alternatively, the results suggest the need to consider the role of regional serendipitous events (Carayannis et al., 2011), implying that such events have diminishing returns in the context of entrepreneurial ecosystems.

6. Conclusion and implications

When it comes to whether regional entrepreneurial activity and unemployment affect each other simultaneously, the straightforward answer is no. There is no reverse causality between new business formation, innovative entrepreneurship, and entrepreneurial ecosystems, on the one hand, and unemployment, on the other. However, at the direct relationship level, negative influences on unemployment and "pull" factors are associated with new business formation and innovative entrepreneurship, respectively. Given the one-country sample, these factors are not dependent on the studied regions. Instead, they depend on the level of entrepreneurial conceptualisation. Furthermore, neither "push" nor "pull" factors explain differences in regional entrepreneurial ecosystem quality. Nor does the quality of entrepreneurship explain unemployment levels.

Since the wave pattern is present in many single-country contexts and the approach to measuring entrepreneurial concepts is market-based rather than motivational, the findings are relevant to regional policymakers where classic market postulates are allowed to operate. A general message for policymakers is the need for a long-term orientation. They should not infer that new business formation is the primary target of one-off policy targeting. The reason is not only the mostly nonexistent response to externally oriented shocks, but also the response to changes in its previous levels. Coupling those findings with the fact that its historical values primarily drive the forecasted values of new business formation lends credence to the need for a long-term-oriented policy approach. Support for a long-term approach is also evident in prompt market reactions to innovative entrepreneurship, which can lead to lasting beneficial effects over a longer time frame. Policymakers should also be attentive to the lack of causal impact of entrepreneurial ecosystems on unemployment and the negative contingency of entrepreneurial ecosystems on their previous values. Although entrepreneurial ecosystems benefit entrepreneurs, as evidenced in the literature, their role in regional performance can be questioned, especially because they require a substantial pool of resources to reverse the naturally deteriorating trajectory of entrepreneurial ecosystem quality. How and to what extent the deployment of resources is optimal for boosting entrepreneurial ecosystems remains a question best answered by each policymaking group for its specific circumstances and targeted levels of competitiveness.

There are also practical implications relevant to entrepreneurs themselves. The role of business environments' attractiveness for entrepreneurial entry or exit is rarely questioned (Hajduova et al., 2021). For the most part, entrepreneurs and their performance respond negatively to increased market competition (Li, 2017; Plummer et al., 2022). According to this study's results, once a level of innovative ventures is established, it persists. Therefore, entrepreneurs in such environments should not anticipate significant changes. Entrepreneurs should instead expect continuous competitive pressure, which they should use to adjust their strategies and ongoing operations. Moreover, additional pressure on businesses comes from the failure of entrepreneurial ecosystems to provide a continuous, stable, and favourable environment. Given their high dependence on favourable entrepreneurial ecosystems, entrepreneurs managing purpose-oriented firms should be especially aware of this implication (Carle & Rayna, 2025).

All the reported results are susceptible to certain limitations. The first is the time frame. This study's time dimension is equal to twenty-three, making it of moderate length compared to other PVAR-based papers. While not inherently a critical drawback, extending the moderate time frame would have instilled more confidence in the model estimation. Somewhat related is the use of yearly data. Quarterly data are seldom utilised (e.g., Aubry et al., 2015). A more frequent dataset would have revealed more intricate relationships amongst the chosen variables and could have been used to test the wave pattern explicitly. The latter leads to the final limitation. The implications of new business formation and innovative entrepreneurship for unemployment depend on the wave-interpretative framework, as the long-term effects are not explicitly accounted for. Using complementary frameworks to interpret results is a common practice in the field. Also, the wave model is the most robust for regional comparisons across countries. Nevertheless, this framework may not be entirely suitable for the provided interpretations.

Future research can enhance the validity of this study's results by mitigating or eliminating the limitations outlined above. In other words, a more robust framework within the confines of a replication study is a potential path forward. While on the topic of replication, there has recently been an uptick in authors calling for replication papers (Köhler & Cortina, 2021). Using that basis, future studies could adopt the model construction presented here and apply it to a different single-country context. Assuming the results are confirmed, there is more substantial evidence to support the main conclusion. On the other hand, the potential for further theorising would be more noteworthy if the results were not confirmed. From a theoretical standpoint, the promising path forward is to develop a conceptual entrepreneurial ecosystem model that accommodates the empirical findings of this study.

As mentioned, incorporating regional serendipity, high resource-endowment requirements, and/or more intricate specification of potential outcomes is a promising pathway for a still-emerging field of inquiry. Lastly, once the micro-level data are made available, future research can further scrutinise the findings of this study. For instance, future investigations can uncover whether different types of innovative entrepreneurship are linked to regional economic performance, as well as decipher the potential connection between the demographic characteristics of entrepreneurs managing those firms and regional economic performance.

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Biography

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Сагледавање цјелокупне слике: Повезивање оснивања нових предузећа, иновативног предузетништва и предузетничких екосистема са незапосленошћу

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Кључне ријечи:
Оснивање нових предузећа;
Иновативно предузетништво;
Предузетнички екосистеми;
Регионално предузетништво;
Стопа незапослености;
Панел подаци

JEL класификација:
L26, E24, R1

САЖЕТАК

Веза између оснивања нових предузећа и незапослености предмет је расправе у научној литератури већ деценијама. Како је вријеме одмицало, појављивали су се нови увиди захваљујући све широј примјени методолошки сложенијих приступа. Ипак, и даље постоји празнина у разумијевању начина на који иновативни предузетници реагују на промјене у незапослености и обрнуто. Слично томе, постоји мало емпиријских доказа о односу између предузетничких екосистема и незапослености. Да би се ове празнине превазишле, подаци су прикупљени на регионалном нивоу, а резултати три панел векторска ауторегресиона модела показују да не постоји обрнута каузалност између оснивања нових предузећа, иновативног предузетништва и предузетничких екосистема, с једне стране, и незапослености, с друге стране. Међутим, потврђене су двије директне везе. Прво, оснивање нових предузећа има негативан утицај на незапосленост. Друго, незапосленост представља негативни претходник иновативног предузетништва. Неочекивано, ауторегресиони коефицијент предузетничког екосистема је негативан. Ови налази су интерпретирани у оквиру робусних теоријских и објашњавајућих оквира. Сходно томе, резултати овог истраживања могу послужити широком и разноликом кругу регионалних креатора политика при осмишљавању стратегија регионалног развоја..