CIRCLE
CENTRE FOR
INNOVATION RESEARCH

Unlocking Firm Innovation in Peripheral Regions: The Critical Role of Local Psychological Openness

Markus Grillitsch, Sam Tavassoli, Martin Obschonka

Paper in Innovation Studies no. 2025/07

Unlocking Firm Innovation in Peripheral Regions: The Critical Role of Local Psychological Openness

Markus Grillitsch[1], Sam Tavassoli[2] and Martin Obschonka[3]

ABSTRACT

Firms in peripheral and less knowledge endowed regions often struggle with innovation, as it is deeply rooted in and influenced by local characteristics. Although recent research highlights the significant, yet complex and hard-to-quantify role of local 'soft factors' such as culture and macro-psychology (e.g., local psychological openness) for firm innovation, we know relatively little about its specific role for firms located in the knowledge periphery. This study examines the hypothesis that favorable local soft factors, such as psychological openness, can compensate for unfavorable local hard factors for innovation of firms located in the knowledge periphery. Drawing upon Schmookler's scissor metaphor, we theoretically elaborate how local psychological openness impacts firm innovation by shaping both the demand and supply sides of the innovation process. In our arguments, we also incorporated the contingent impact of both regional (external) and firm (internal) factors on the relationship between local psychological openness and firm innovation. Our empirical investigation of a large and longitudinal sample of Swedish firms across 2004 to 2018 revealed a compensatory effect of local psychological openness for local 'structural knowledge gaps' in less endowed peripheral regions. Implications for research and policymaking addressing innovation in firms and regions are discussed.

Keywords: firm innovation, local psychological openness, knowledge spillovers, peripheral regions

[1] Department of Human Geography and CIRCLE – Centre for Innovation Research, Lund University, Sweden; markus.grillitsch@keg.lu.se

[2] Deakin Business School, Deakin University, Australia and CIRCLE – Centre for Innovation Research, Lund University, Sweden; s.tavassoli@deakin.edu.au

[3] Amsterdam Business School, University of Amsterdam, The Netherlands; m.obschonka@uva.nl

INTRODUCTION

The *complexity* of factors and mechanisms shaping firm innovation is widely acknowledged. This complexity concerns not only the within-firm factors but also emphasizes the importance of location – those regional and local factors and dynamics that interact with the focal firm to enhance its success in the innovation process (Feldman, 1994). This complexity is given particular attention not only in research but also in policy making (Howoldt, 2024). This has been traditionally the subject of regional innovation system and related literature (Cooke, 1992), which is more recently referred to as ecosystem in innovation studies (Baldwin, Bogers, Kapoor, & West, 2024).

One of the most central research questions and policy foci in this context focuses on stark (and often persistent) *regional disparities* in innovation (Tavassoli & Karlsson, 2018; Audretsch & Feldman, 1996). While a vast amount of research indicates a privileged position of vibrant urban economies (Duranton & Puga, 2004; Glaeser, 2011; Glaeser et al., 1992), the topic of peripheral regions and more recently 'left-behind' regions has become a major focus in the scholarly, political, and public debate in recent years (MacKinnon et al., 2022; Pike, 2024; Rodríguez-Pose, 2018). For example, peripheral and less knowledge endowed regions have become the focal point of innovation policies aimed at stimulating innovation, often with considerable effort and expense, and relatively disappointing results (OECD, 2013). This resistance to improvement affects not only these regions (and society overall) in terms of economic prosperity but also extends to various other domains (e.g., political, sociodemographic, and cultural consequences, Pike, 2024; Rodríguez-Pose, 2018). Therefore, it has become increasingly urgent to better understand the root causes of the persistent uneven regional development patterns. One frequently discussed reason in this context is the so-called *innovation paradox*.

The innovation paradox suggests that those regions most in need of innovation often possess the least capacity to generate it (Oughton, Landabaso & Morgan, 2002). Importantly, these structural gaps are typically defined via *hard factors*. For example, many smaller cities and peripheral areas, which are often in greatest need of innovation to stimulate economic development, tend to offer a less diverse and knowledge-intensive environment, in addition to the absence of traditional agglomeration effects (Grillitsch & Nilsson 2015). This is related to lack of resources (e.g., funding for R&D, infrastructure), institutional barriers (e.g., inadequate intellectual property protection and inefficient government policies), educational gaps (e.g., shortage of educational institutions and programs that provide the advanced training and skills required for innovation), market limitations (e.g., smaller or less developed markets may not provide the same opportunities for scaling up new innovations), absorptive capacity (e.g., ability to absorb, adapt, and implement new technologies and innovations is often lower in these regions due to a lack of technical knowledge and supportive ecosystems), and brain drain (e.g., talented individuals from these regions may move to more developed areas with better opportunities). Consequently, due to these limitations in critical hard factors, these left-behind regions continuously suffer from less favorable preconditions for local innovation (Iammarino, Rodriguez-Pose & Storper 2019). In contrast, larger cities typically benefit from more favorable hard factors, such as a diverse and knowledge-intensive environment boosting local innovation (Jakobs, 1969, Glaeser et al., 1992, Duranton and Puga, 2004).

In addition to so-called hard factors, larger cities benefit from favorable *soft factors* such as an innovation culture, creativity, tolerance, lower innovation resistance, networks and collaborations (Florida, 2002; Glaeser, 2011; Scott, 2006). This raises the question whether such favorable soft factors can compensate for structural gaps in hard factors in less endowed peripheral regions. For example, whether peripheral regions that feature high levels of local psychological openness, as a soft factor, can achieve high firm innovation, despite structural

gaps in hard factors. Indeed, there is an emerging yet limited literature suggesting that it might be particularly the soft factors that can boost firm innovation in such structurally less-endowed regions. For example, research indicates that intensified collaboration with other actors outside the region is critical for innovation of firms in peripheral regions (Grillitsch & Nilsson 2015).

Here we advance this literature on compensation mechanisms linked to soft factors working 'against the odds' – against this innovation paradox holding certain regions back from achieving better innovation outcomes. Specially, we elucidate the importance of local psychological openness for firm innovation in disadvantaged regions. Whereas such psychological openness has been indirectly or directly highlighted in seminal theorizing on regional innovation and economic prosperity (e.g., Jacobs, 1969; Florida, 2002; Saxenian, 1994), empirical research has only recently begun to assess this soft factor in more direct ways (Mewes et al., 2022; Obschonka et al., 2023; Rutten, 2019; Tavassoli et al, 2021). While this existing research has demonstrated an effect of local psychological openness on *aggregate* innovation via the facilitation of local actors' ability to identify and appropriate new knowledge and to form new networks (e.g., Obschonka et al., 2023), it is unclear how it affects innovation at the level of the firm, and in smaller and more peripheral regions that do not exhibit the agglomeration economies of cities, for which most empirical studies have been conducted. This focus on regional soft factors is part of a broader trend to emphasize the importance of soft factors in theorizing and empirical research, such as culture (Pfotenhauer et al., 2023). Importantly, this trend is not focused on the top performing regions but also aims to promote 'innovation for the masses,' ensuring that innovation is not permanently concentrated in a few well-off areas, thereby leaving other regions behind (Lee, 2024).

In this paper, we shed new light on the innovation paradox via our focus on the role of local psychological openness. Specifically, we explore the question of how local psychological openness affects firm innovation outcomes differently, depending on the extent of firms'

location peripherality, namely regions' size and knowledge intensity. To do this, theoretically we build on Schmookler's Scissors metaphor (Schmookler, 1966), elucidating how local openness can positively influence firm innovation by enhancing both the demand and supply sides of the innovation process. Specifically, on the supply side, we identify three functions of local openness that support firm innovation: cascade, magnet, and spillover-enhancer, while on the demand side we identify one function of local openness namely adoption-enhancer. We further theorize that the impact of local openness on firm innovation is contingent upon a combination of firm-internal and locational factors. In this way, we incorporate both macro- and micro-level moderators into the relationship between local openness and firm-level innovation outcomes.

Our empirical study is conducted in Sweden, which offers some advantages for this study. Sweden is a highly innovative country where basic conditions for innovation such as good governance, public infrastructure, and education are met in both larger and smaller cities. However, larger cities are characterized by a larger demand, higher diversity, and higher knowledge-intensity as compared to smaller cities and the periphery. Furthermore, in Sweden, we can draw on eight waves of the Community Innovation Survey from 2004 to 2018, linked to employee-employer register data geo-coded at the level of municipalities, providing 21,049 firm observations. This is further linked with personality data provided by the Gosling-Potter Internet Project (Rentfrow et al., 2008; Ebert et al., 2022; Obschonka et al., 2025), allowing us to calculate local openness score at the level of municipalities. We cover 48 municipalities in Sweden covering larger and mid-sized cities and smaller towns. This unique data allows us to test the relationship between local openness and firm innovation depending on regional and firm characteristics.

Our study contributes to the innovation literature in the following ways. First, we theorize and empirically test the effect of local psychological openness on firms' innovation outcomes,

conditioned by factors external as well as internal to firms. This is important because existing openness-innovation studies solely investigate relationships at the aggregate level of cities (e.g., Tavassoli et al, 2021; Ebert et al., 2022; Obschonka et al, 2023), offering limited empirical and theoretical insights into how the effect of regional psychological openness manifests at the firm level, through specific innovation mechanisms and outcomes. Indeed, a surprising finding in our study indicates that local openness was not related to firm innovation for firms located in larger and knowledge-intensive regions. This is counterintuitive at first sight because large cities are typically synonymous with openness, knowledge, and innovation. However, this observation may exemplify a fallacy of composition, as described by Elster (1978). We further discuss such findings in the discussion section.

Secondly, we then contribute to the debate on the innovation paradox and peripheral regions by demonstrating that the positive effect of local openness on firm innovation is more pronounced for firms located in smaller towns and less knowledge-intensive regions. This suggests that local openness may effectively assist firms in these areas to seek and find the necessary conditions for innovation beyond their immediate region. In other words, local openness extends Schmookler's scissors beyond regional boundaries. This is particularly significant, as most studies in this field have concentrated on larger cities, especially in the US context (Tavassoli et al., 2021; Obschonka et al., 2023) and may have overlooked key innovation mechanisms and outcomes in smaller cities and rural areas, as well as other countries in general (Fritsch & Wyrwich, 2021), which are often more susceptible to the innovation paradox.

THEORY AND HYPOTHESIS DEVELOPMENT

Innovation is a critical factor for the competitiveness and growth of firms. The drivers of firm innovation have been extensively studied across various disciplines, resulting in a rich body of

literature. One body of research focused on internal factors within firms and investigated both tangible ‘hard’ factors like firm size, age, and R&D investments (Cohen and Klepper, 1996) and ‘soft’ factors such as workforce agility (Franco and Landini, 2022) and knowledge diversity of employees (Bogers et al., 2018) as well as managers (Schubert and Tavassoli, 2020). Another body of literature looked at external factors, particularly knowledge networks of firms and their variation based on regional context (e.g., Tojeiro-Rivero and Moreno, 2019). While these bodies of literature predominantly focus on the ‘supply’ side of the innovation process, a smaller yet noteworthy body of earlier research highlights the influence of 'demand' and market dynamics, where consumer needs and preferences drive firms to innovate (Schmookler, 1966; Von Hippel, 1986), and where market competition acts as a catalyst for innovation (Aghion et al., 2005). In the following section, we will synthesize such supply and demand perspectives and introduce an additional dimension related to soft factors external to the firms: the impact of an important macro-psychological factor on the innovation outcome of firms, through influencing both supply and demand mechanisms. Then we will theorize how the impact of such macro-psychological factor on the firm innovation is further conditioned by the regional and firm-level factors.

Local Psychological Openness and Firm’s Innovation Output

Contemporary analyses and diverse viewpoints on the drivers of firm innovation, let it be internal or external factors, can be associated with the ideas of Jacob Schmookler, who highlighted the significance of both supply (technology push) and demand (market pull) factors. According to the Schmookler's Scissors metaphor (Schmookler, 1966), demand and supply are the two indispensable blades of the scissors that are both necessary and working in conjunction to ‘cut’ or in other words to drive innovation at the firm level. Demand refers to customers’ eagerness to try new things, while supply refers to technological advancements (including

technology itself but also individuals driving such technological advancements). A thorough review of innovation sources in the literature reaffirms the significance of both components of Schmookler's Scissors (Di Stefano, Gambardella, and Verona, 2012). Furthermore, this concept has been shown to be crucial not only for firm-level innovation outcomes but also for sparking the creation of new industries through innovation (Feldman and Tavassoli, 2015; Peters et al., 2012). Building on this foundation, we introduce a novel angle by suggesting that local psychological openness can effectively 'sharpen' both blades of these metaphorical scissors, thereby enhancing the innovation outcomes of firms.

From a supply standpoint, we propose that local openness may enhance the innovation of firms through three functions. First, if a locality features a disproportionate share of a psychologically open population, then the existence of such local openness can ‘cascade’ into innovators and researchers within firms in such localities through institutionalised social norm (Obschonka et al., 2023). In particular, the behavioural tendencies associated with openness become accepted and socially valued, i.e., informally institutionalized in social norms (Huggins and Thompson, 2017). Such institutionalised social norm in favour of openness positively enhances the creativity and innovativeness of individuals working on innovative projects located in such localities (Mewes et al., 2022). We refer to this function of local openness in enhancing innovation of firms as the *cascade function*. Second, the existence of local openness acts as a magnet and attracts the migration of creative and innovative people into the locality (Florida, 2002; Rutten, 2019). This in turns enhances the supply of local human capital necessary for firms’ innovation. We refer to this function of local openness in enhancing innovation of firms as the *magnet function*. Third, local openness enhances the knowledge spillover among people within the same locality (Tavassoli et al., 2021) and between different localities (Obschonka et al., 2023). The within knowledge spillover is facilitated by local openness because open people are receptive to new ideas and hence, they are likely to

understand, encourage, and exchange them. The between localities knowledge spillover is facilitated by local openness because local openness can act as a conduit for the locality to be connected to external knowledge sources from outside the regions (Obschonka et al., 2023). This is particularly done via local populations being open to catch new trends and knowledge from outside the regions through social connectedness, for example friendship networks of local people to other people residing in knowledge reach localities (Rutten, 2019; Obschonka et al., 2023). Such between and within locality knowledge spillover is known to be crucial for innovation of firms. We refer to this function of local openness in enhancing innovation of firms as the *spillover-enhancer* function.

From a demand standpoint, a high local psychological openness implies that local market is composed of people that are open to new experiences. This creates a favourable local environment for newly introduced products and services to be better accepted and adopted by the market, hence a higher chance of innovation success at least locally. We refer to this function of local openness in enhancing innovation of firms as the *adoption-enhancer* function. Such a favourable local environment can be a catalyst for innovation in two ways. First, it can encourage firms to allocate more resources to R&D, knowing that there is a general appetite in the local market for novel products and services. This is in line with signalling theory in management research (Connelly, Certo, Ireland, & Reutzel, 2011). Second, local openness can lead to a more dynamic market, where feedback loops between consumers and firms are quicker and more constructive, allowing for rapid iterations and improvements in products and services (Von Hippel, 1986). This in turn will lead to higher chance of success in firm's innovation[1].

[1] We note that local openness likely exerts a stronger impact on the supply factors than on the demand factors influencing firms' innovation. This inference is based on the identification of three functions explaining the supply side effect discussed above. On the demand side, while local openness can directly increase the local market's receptiveness to new goods and services, innovative firms often extend beyond local markets, achieving a broader market reach. This wider scope may lessen the relative impact of local openness on the demand side for these firms. Nevertheless, when considering both supply and demand aspects, we propose that local openness is expected to positively affect firms' innovation outcomes by

Our theoretical refinement of the impact of local psychological openness on firm innovation above, based on Schmookler's Scissors metaphor, forms the basis for our cross-level interaction effects between firms' internal and external factors presented in the following. This led us to highlight that local psychological openness should not drive firm innovation via a universal positive effect, but via a systematic interplay with knowledge-related endowment of regions, and firms themselves.

Compensating for 'Structural Knowledge Gaps'

We propose that the relationship between local psychological openness and innovation outcomes of firms is conditioned by important external factors to firms, namely the endowment of the locality in terms of population size and knowledge intensity. We will elaborate on our claim by referring to both the supply and demand aspects in the Schmookler's Scissors. In terms of supply side, above we proposed three functions of local openness that explain the effect of local openness on firm innovation. We acknowledge that the cascade function is anticipated to operate similarly across small and large localities because this function is essentially about institutionalised social norm which can be independent of the size of the localities (Inglehart & Baker, 2000). Hence the size of localities may not play a role on how this function works. However, the other two functions may be more pronounced in smaller localities compared to larger ones. Specifically, the 'magnet function' —the attraction of creative and innovative individuals due to the magnet effect of local openness—is likely to be more crucial in smaller localities and knowledge peripheral localities. This is because these areas typically possess fewer creative and innovative residents relative to larger localities, thereby making local openness potentially more advantageous for smaller localities.

enhancing both elements of Schmookler's Scissors metaphor, albeit with a more pronounced effect on the supply blade than on the demand blade.

Moreover, the spillover-enhancer function—which amplifies knowledge spillovers both within and between localities due to local openness—is likely more vital in smaller and knowledge peripheral localities. This is because such localities typically have fewer local knowledge pools, resulting in firms within these areas having reduced access to local knowledge sources and local knowledge spillovers (Grillitsch & Nilsson, 2015). Under such circumstances, the local psychological openness can compensate for the lack of local knowledge access by facilitating the knowledge spillover between localities. As noted above, this is done mainly by connecting the small localities to outside knowledge pools through social networks for example as well as absorbing inflowing knowledge (Obschonka et al., 2023). In contrast, firms in larger cities benefit from inherent access to extensive knowledge pools and the intensive 'pressure cooker effect' of local knowledge spillovers and learning, as dictated by the geographical context (Glaeser et al., 1992). Therefore, in such urban settings, local psychological openness may play a less critical role in firm innovation. It is conceivable that an excess of exposure to local knowledge could even be counterproductive, leading to complications, an overabundance of ideas and options, dilution of focus, and a propensity towards a 'hipster' or artistic district rather than a serious innovation hub.

In terms of demand, in low density and peripheral localities, firms are typically more closely connected with the local community (Pato & Teixeira, 2016), allowing for a more pronounced impact of local openness in strengthening the market-pull factor and hence firm's innovation outcome. This is because these firms may receive clearer and stronger signal from the open local market which further encourages them to allocate more resources to R&D, knowing that there is a general appetite in the local market for novel products. Moreover, being closely connected to the local community in smaller places, feedback loops between consumers and firms are quicker and more constructive, allowing for even more rapid iterations and improvements in products and services. Even though innovative firms typically tend to operate

beyond their own localities, nevertheless, a strong local market base, which can be strengthened by local openness, can strengthen innovativeness of firms in small cities. In larger cities, however, the impact of local openness on the innovation outcomes of firms becomes more intricate. In particular, the emergence of local openness effects in larger cities is contingent upon the presence of additional factors, such as the diversity of activities and talents, which are essential for realizing these effects (Rutten, 2019; Tavassoli et al., 2021). Moreover, high density areas might introduce challenges like competition for resources or noise that could dampen the local openness effect. We further note that even if low density and peripheral region typically have lower openness level than bigger cities, nevertheless, if such peripheral regions possess some level of local openness, the impact of such local openness on local firms' innovation are expected to be more pronounced. To sum up, we propose that the more peripheral a region is (i.e., with fewer local endowments), the stronger the impact of local psychological openness on firm innovation. We have formulated this proposition into the following hypothesis.

H1: There is a negative moderating effect of local endowment on the relationship between local psychological openness and firm innovation: The lower local endowment of a region in terms of (a) population density and (b) knowledge intensity (i.e., the more peripheral a region is), the stronger the impact of local psychological openness on firm innovation.

The Role of Firm's Internal Knowledge-Related Endowment

So far in hypothesis 1 we have discussed the moderating impact of localities' population and knowledge intensity, as external (regional level) factors, proposing that in smaller and knowledge periphery localities the impact of openness on firm innovation is more pronounced. This implies a compensation effect of local openness for structural knowledge gaps in such peripheries. However, within a locality (e.g., small and knowledge periphery locality), firms are not the same in terms of their absorptive capacity or internal knowledge, e.g., the portion of

highly educated employees within firms (Cohen & Levinthal, 1990). Importantly, such internal characteristics of firms can act as an additional boundary condition for the proposed moderating effect in hypothesis 1. We elaborate on this claim by referring to two supply-related functions namely the magnet and the spillover-enhancer functions respectively. First, firms with a higher absorptive capacity have been demonstrated to excel in scanning their region and effectively recruiting the human capital necessary for innovation (Chang, Gong, Way, & Jia, 2013). Innovation literature also refers to this as '*accessive* capacity' by which firms can effectively scan, collect, sort, and analyse knowledge from both internal and external sources (Robertson, Casali, &Jacobson, 2012). With such superior scanning ability, these firms naturally benefit from a larger pool of innovative individuals attracted to the area (thanks to the *magnetic* effect of local openness). Consequently, firms with greater absorptive capacity are expected to derive more benefits from the magnet function of local openness in smaller localities. Second, firms that have higher absorptive capacity can better absorb and assimilate the knowledge spillover flowing into the localities from outside (that has occurred thanks to the *spillover-enhancer* effect of local openness). For example, Qian and Acs (2013) empirically demonstrated it using entrepreneurs' absorptive capacity in the context of US. Hence, while local openness has a stronger impact in smaller localities compared to the larger ones (Hypothesis 1), we argue that within these smaller localities, it has even a more pronounced effect for firms with higher absorptive capacities in terms of firms' highly educated employees. Accordingly, our second hypothesis is formulated as below.

H2: The negative moderating effect of local endowment on the relationship between local psychological openness and firm innovation is further contingent on the firm's internal absorptive capacity. Specifically, firms with a higher absorptive capacity are likely to experience a stronger positive impact of local psychological openness on their innovation when situated in regions with lower (versus higher) local endowment in terms of (a) population density and (b) knowledge density.

METHODOLOGY

Dataset

In view of this study's objective, examining cross-level effects linking hard and soft factors of different types of regions to firm factors and dynamics, we exploit the particularly suitable data available in Sweden. Here, not only is very detailed and complete firm-level data and regional data on hard factors available, but also macro-psychological data, as explained below.

We combine two types of datasets. First, we measure firm variables using three datasets provided by the Statistical Office of Sweden (SCB)[2]. We use 8 waves of the Community Innovation Survey (CIS) from 2004 to 2018, which is implemented every second year in accordance with the Oslo Manual based on a sample stratified by sector and firm size. The survey includes firms with ten employees or more. The CIS covers innovation activities of firms in the three years prior to the survey and firms are obliged by law to respond to the survey. The CIS data is merged with a linked employee-employer register dataset based on the LISA dataset (Longitudinal Integrated Database for Health Insurance and Labour Market studies) and the FEK dataset (Database on Firms' Economy) also accessed through the SCB. FEK data provides financial control variables at the level of the firm and allows to locate firms in municipalities. The individual level data (LISA) is used to capture the knowledge-intensity at the level of firms and in the municipality in which firms are located using education data.

Second, we measure regional macro-psychological factors (openness at the level of municipalities) by merging a unique macro-psychological dataset with average metrics for the Big Five personality traits. The personality data is provided by the Gosling-Potter Internet

[2] SCB (2019) LISA Longitudinell integrationsdatabas för Sjukförsäkrings- och Arbetsmarknadsstudier, Bakgrundsfakta Arbetsmarknads- och utbildningsstatistiken 2019:1, Statistics Sweden, Örebro,
SCB (2019) Kvalitetsdeklaration, Innovation i företagssektorn - Community Innovation Survey (CIS), Statistics Sweden, Örebro, SCB (2020) Kvalitetsdeklaration, Företagens ekonomi (FEK), Statistics Sweden, Örebro

Project (GPIP) collected at the individual-level over a period from 2000 to 2015 (Rentfrow et al., 2008). This data has been used in several regional studies, however, mainly in the US (Tavassoli et al., 2021; Ebert et al., 2022; Mewes et al, 2022; Obschonka et al, 2023). The data for Sweden, this study draws on, is reported and described in Obschonka et al. (2025) finding a systematic geographic variation in personality traits.

Big Five Personality Trait Data in Sweden was collected originally at the individual level, and individuals could opt to provide a zip-code for their location (Rentfrow et al., 2008; see also Ebert et al., 2022). In total, we aggregated 21,695 individual-level observations to the level of municipalities in Sweden. The geography in Sweden is overall quite well covered by the Big Five survey even though there is a small correlation between coverage and population size of the municipalities (see Annex 1). However, municipalities in Sweden vary in size from below 5000 inhabitants to almost one million (Stockholm), which implies that for the very small municipalities, the Big Five survey yields few observations. With the reliability of the measurement of local openness in mind, we included only municipalities with at least 100 observations in the empirical study. This allows us to cover 48 municipalities in Sweden of which the smallest, Västervik a town in Kalmar region, has somewhat over 35.000 inhabitants (see Annex 2). In the Swedish context, the study thus includes the smaller towns, medium-sized cities, and the larger cities but not the very small municipalities and rural areas. The 48 municipalities with at least 100 observations are distributed across Sweden as Figure 1 shows, frequently with substantial distance between them, and thus provide a relatively large variety of local contexts.

[Figure 1 about here]

Variables

The outcome variable, *firm innovation,* is a dichotomous variable that captures whether firms have generated product or service innovations, defined in the CIS as significantly improved or new products or services, in the three years prior to the survey. Out of the 21,049 firms covered in the study, 36.5% had generated product or service innovations.

Local personality trait measures are municipal-level averages of the individual-level scores for the Big Five personality traits of openness, agreeableness, extraversion, conscientious, and neuroticism. Each of the five traits is an index constructed from the Big Five Inventory, which includes 44 items in total (John and Srivastava, 1999). Each item corresponds to a question in the Big Five Personality survey, to which respondents answer on a Likert scale of 1 to 5. Openness is measured with 10 items measuring among others curiosity, imagination, artistic interest, wide scope of interests, excitement, and unconventionality. Limiting the study to municipalities in which we have at least 100 observations, we find that openness varies between a minimum value of 3.43 and a maximum value of 3.85 (average is 3.70). The other four Big Five personality traits are used as control variables.

In this study, we investigate the relationship between local openness and firm innovation conditional to variations in the size and knowledge intensity of the municipalities, in which the firms are embedded. Size is measured as the log of the population of the municipality. Local knowledge intensity is measured as the ratio of the number of employees in the municipality who have an academic qualification to the total number of workers in the municipality. As mentioned earlier, the size of municipalities varies from approximately 35.000 inhabitants in Västervik to almost one million in Stockholm. The knowledge intensity at the level of municipalities ranges between 23% and 57% with an average value of 39%.

In a next step, we investigate the above interrelation between openness and regional characteristics conditional to the knowledge intensity of firms, which we use as a proxy for

absorptive capacity. This is because firm innovativeness, and the possibility to draw on firm-external knowledge is directly linked to the knowledge firms hold in-house. Knowledge intensity at the level of the firm is measured as the ratio of the number of employees in the firm who have an academic qualification to the total number of employees of the firm.

As control variables, we include the size of the firm measured as log of the number of employees, the profitability of the firm measured as ratio between profits and assets in million SEK, as well as industry dummies and dummies for each CIS wave. The descriptive statistics and correlation coefficients between variables are provided in Table 1. Few points are worthy to note regarding correlation coefficients. First, the highest Vector Inflation factor (VIF) is 3.39 and the condition index is 4.2. Both are thus clearly below the threshold values, which would indicate a potential problem with multicollinearity. Second, local knowledge intensity and local population have somewhat high correlations with each other (and indeed the VIFs are highest for these variables). This represents the fact that knowledge intensity tends to be higher in larger localities. However, there is geographic variation with some smaller localities having a relatively high knowledge intensity. Therefore, and given that the tests for multicollinearity are unproblematic, we proceed with both measures for local endowment. Furthermore, as robustness check, we have implemented a principal component analysis, which combined these two variables into one main component and the results remain robust and are qualitatively identical.

[Table 1 about here]

Econometric Models

We estimate the following baseline probit model, which tests for the average effect of local openness on firm innovation:

$$(1)\ Inno_{i,t,m}=\alpha + \beta 1 LocalBigFive_{m} + \beta 2 Local_{m,t-2} + \beta 3 Firm_{i,t-2} + \gamma Industry_{i} + \varphi CIS_{t} + \varepsilon_{i,t}$$

where the innovativeness of a firm ($Inno_{i,t,m}$) is explained by the local personality trait measures ($LocalBigFive_m$), one of which is local openness, variables of the localities in which the firms are embedded ($Local_{m,t-2}$), firm-level variables ($Firm_{i,t-2}$), dummies for the industry and time. $\varepsilon_{i,t}$ stands for a random error term. The local variables include the log size of the municipality and the local knowledge intensity. The firm-level variables include the knowledge intensity of the firm, firm size, and firm profitability. The measures for the local-level and firm-level variables are taken at the beginning of the period, which is covered by each CIS-wave. For instance, the first CIS-wave from 2004 asks for firm innovativeness in the period from 2002 to 2004. Measures for firm- and local-level variables are then taken in 2002 (t-2). The local personality trait variables are considered time-invariant, as they reflect cultural attributes, which change slowly over time (Mewes et al., 2022). Yet, the focus of the analysis is on conditional effects of local openness, which are estimated as follows:

(2) $Inno_{i,t,m}=\alpha + \beta 1 LocalBigFive_m + \beta 2 Local_{m,t-2} + \beta 3 Firm_{i,t-2} + \beta 4 LocalOpen_m * LocalPop_{m,t-2} + \gamma Industry_i + \varphi CIS_t + \varepsilon_{i,t}$

(3) $Inno_{i,t,m}=\alpha + \beta 1 LocalBigFive_m + \beta 2 Local_{m,t-2} + \beta 3 Firm_{i,t-2} + \beta 4 LocalOpen_m * LocalKI_{m,t-2} + \gamma Industry_i + \varphi CIS_t + \varepsilon_{i,t}$

(4) $Inno_{i,t,m}=\alpha + \beta 1 LocalBigFive_m + \beta 2 Local_{m,t-2} + \beta 3 Firm_{i,t-2} + \beta 4 LocalOpen_m * LocalPop_{m,t-2} + \beta 5 LocalPop_{m,t-2} * FirmKI_{i,t-2} + \beta 6 LocalOpen_m * LocalPop_{m,t-2} * FirmKI_{i,t-2} + \gamma Industry_i + \varphi CIS_t + \varepsilon_{i,t}$

(5) $Inno_{i,t,m}=\alpha + \beta 1 LocalBigFive_m + \beta 2 Local_{m,t-2} + \beta 3 Firm_{i,t-2} + \beta 4 LocalOpen_m * LocalKI_{m,t-2} + \beta 5 LocalKI_{m,t-2} * FirmKI_{i,t-2} + \beta 6 LocalOpen_m * LocalKI_{m,t-2} * FirmKI_{i,t-2} + \gamma Industry_i + \varphi CIS_t + \varepsilon_{i,t}$

The second and third model include the two-way interactions between local openness ($LocalOpen_m$) and local population ($LocalPop_{m,t-2}$), and between local openness ($LocalOpen_m$) and local knowledge intensity ($LocalKI_{m,t-2}$) respectively. Models 4 and 5 introduce three-way interactions, testing for the effects of local openness on firm innovation conditional to firm-

level knowledge intensity ($FirmKI_{i, t-2}$) and the size of the local population and local knowledge intensity. Variables are centred to improve interpretation and reduce artificial multicollinearity introduced by interaction terms. All models are estimated with standard errors clustered at the level of municipality at which the local personality trait variables are measured. For the ease of interpretation, we present figures that show the average marginal effects of local openness on firm innovation at different levels of the respective interaction variables.

RESULTS

Table 2 shows the baseline effects of local openness on firm innovation. A stepwise inclusion of variables is reported. Model 2a includes local openness and industry and time dummies only, and Model 2b introduces the other personality traits. In these models, local openness is positively related to firm innovation. One important observation is that local openness appears to be the most relevant personality trait for firm innovation. When introducing the regional variables of local population and local knowledge intensity in Model 2c, however, the coefficient and significance of local openness reduces. This speaks to the general observation that local openness, local population size, and local knowledge intensity are correlated (e.g., Lee, 2017; Tavassoli et al, 2021; Obschonka et al, 2023).

[Table 2 about here]

Table 3 presents the effects of local openness on firm innovation conditional to the size of the local population, the local knowledge intensity, and firm's knowledge intensity. Model 3a includes the interaction effect between local openness and local population. The effect is negative and significant. Hence, local openness is associated more with firm innovation in peripheral (small) municipalities than in central (larger) municipalities. Model 3b presents the results with the interaction between local openness and local knowledge intensity. Similar to 3a, this interaction effect is negative and significant as well, suggesting that local openness

matters more for firm innovation in municipalities with low local knowledge intensity than in municipalities with high local knowledge intensity. Hence, the results of Models 3a and 3b corroborate H1a and b respectively, which stipulate that local openness is more important for the innovativeness of firms located in the knowledge periphery than for firms located in the knowledge centres. Models 3c and 3d estimate the three-way interactions of local openness, population, and firm knowledge intensity, as well as local openness, local knowledge intensity, and firm knowledge intensity respectively. The three-way interaction effects are statistically significant, yet a substantive interpretation requires an analysis of the conditional average marginal effects.

[Table 3 about here]

The interpretation rests on estimating the average marginal effects of openness on firm innovation conditional to the other variables of interest. We start with the interpretation of the results of the two-way interactions before moving on the three-way interactions. Figure 2A is based on Table 3 Model 3a and it depicts the average marginal effects of openness on firm innovation conditional to the size of the local population. The figure shows that local openness is positively related to firm innovation in small municipalities (low population) with an average marginal effect of close to 0.2. This means that if local openness increases by 0.3 (from low local openness to high local openness), the probability for a firm to be innovative increases by approximately 6 percentage points in small municipalities. The average marginal effect decreases with the increasing population of the municipality. For large municipalities, there is no evidence that local openness predicts firm innovativeness.

Figure 2B is based on Table 3 Model 3b and it shows the average marginal effects of openness on firm innovation conditional to the local knowledge intensity. The downward-pointing slope is indicative for the negative interaction effect. In municipalities with low local knowledge intensity, local openness has a positive and statistically significant effect on firm

innovativeness. In municipalities with high local knowledge intensity, there is no statistically significant effect of local openness. In municipalities with low local knowledge intensity, the average marginal effect is close to 0.3. This suggests that a change in local openness by 0.3 (from low to high local openness) is on average related to a 9 percentage points higher likelihood for firms to be innovative.

[Figures 2A and 2B about here]

Figures 3A and 3B facilitate the interpretation of how local openness is related to firm innovation depending on the knowledge intensity of firms and local characteristics. They are based on Table 3 Model 3c and Model 3d respectively. Figure 3A depicts the average marginal effects of local openness at different levels of firm-level knowledge intensity in small versus large municipalities (population log=10.5 versus 13.5). First, Figure 3A shows that no significant relationship of local openness could be detected for firms that have a low knowledge intensity. The relationship of local openness increases/decreases with the level of firm-level knowledge intensity and becomes statistically significant at a medium firm-level knowledge intensity (approximately 45% of the employees have academic training). If firms have a high knowledge intensity (80% of the employees have academic training), local openness has a positive effect on firm innovativeness in small municipalities but a negative effect in large municipalities with average marginal effects of 0.5 and -0.7 respectively. This is a substantial difference and suggests that a change of local openness by 0.3 (from low to high local openness) relates on average to a 36 percentage points higher probability that knowledge intense firms are innovative in small municipalities as compared to large municipalities.

Figure 3B provides a view on the average marginal effects of local openness on firm innovativeness depending at different levels of firm knowledge intensity for firm located in municipalities with low and high local knowledge intensity respectively (25% vs 55% of the

local labour force has academic training). At low levels of firm knowledge intensity, local openness has no significant effect on firm innovativeness. However, the relationship is upward sloping in municipalities with low local knowledge intensity and downward sloping in municipalities with high local knowledge intensity. For firms with medium to high levels of knowledge intensity, this implies that local openness has a positive effect in municipalities with low levels of local knowledge intensity but a negative effect in municipalities with high levels of local knowledge intensity. At high levels of firm knowledge intensity (80%) the average marginal effect of local openness is approximately 0.7 if local knowledge intensity is low and approximately -1 if local knowledge intensity is high. Hence, for firms with a high knowledge intensity, the difference between low and high local openness (0.3) would imply on average a 51 percentage points higher probability that knowledge intense firms are innovative if located in municipalities with low local knowledge intensity than if located in municipalities with high local knowledge intensity.

To summarize, local openness compensates for less endowed peripheral regions when it comes to firm innovation, but this compensation effect also depends on the firm's endowment (firm knowledge intensity): if there is more firm endowment, then this compensation effect becomes even stronger.

[Figures 3A and 3B about here]

DISCUSSION

What unlocks firm innovation in peripheral and less knowledge-endowed regions? We addressed this important question by focusing on the critical role of regional differences in psychological openness, which interacts systematically with regional-level (external to the firm) and firm-level (internal to the firm) factors. To do so, we built our argument using Schmookler's scissors metaphor to comprehensively integrate both the supply and demand

sides of the innovation process. Specifically, we first established a theoretical foundation for why local openness may positively influence firm innovation from both supply and demand perspectives. We identified and explained three supply-side functions of local openness that enhance firm innovation: cascade, magnet, and spillover-enhancer. From the demand side, we identified one function, adoption-enhancer. After establishing this theoretical basis for the relationship between openness and firm innovation, we developed hypotheses that incorporate both external and internal firm factors as moderators of the openness-innovation relationship.

Our study makes two key contributions to the innovation literature. First, we develop and empirically test the role of local psychological openness on firms' innovation outcomes, while accounting for both internal firm factors and external regional conditions. This adds a new dimension to the existing openness-innovation discourse, which has predominantly examined the relationship at a macro-level—focusing on cities as aggregate units (e.g., Tavassoli et al., 2021; Ebert et al., 2022; Obschonka et al., 2023). By shifting the focus to the firm level, our study highlights how regional psychological openness influences innovation mechanisms and outcomes within firms, which has been underexplored in previous research. Relatedly, a notable and counterintuitive finding in our analysis reveals that local openness does not correlate with firm innovation in larger, knowledge-dense regions. This contrasts with the conventional wisdom that large cities—typically associated with openness, knowledge exchange, and innovation—should naturally foster firm-level innovation. We suggest this may represent a fallacy of composition (Elster, 1978), where what is true at the macro level does not necessarily hold at the micro level. One plausible explanation is that, in highly knowledge-intensive urban areas, local openness might lead to knowledge spillovers that inadvertently harm firms by facilitating knowledge leakage to competitors (Alcácer & Chung, 2007). Additionally, firms in these environments may face an overabundance of ideas, necessitating a more selective, focused approach to innovation in order to prevent fragmentation of efforts.

Second, our findings contribute to the ongoing debate surrounding the innovation paradox—the discrepancy between innovation need and outcome in peripheral regions. We demonstrate that local psychological openness can help to rectify innovation paradox. This is because our findings show that local openness has a more substantial impact on firm innovation particularly in smaller towns and less knowledge-intensive regions, indicating that openness enables firms in these areas to connect with broader innovation networks beyond their immediate geographical constraints. In this context, Schmookler's scissors extend beyond regional boundaries, suggesting that local openness may mitigate the limitations of peripheral regions by fostering access to external knowledge and resources. This is a critical finding, as much of the literature on innovation has disproportionately focused on large urban centers, particularly in the United States (Tavassoli et al., 2021; Obschonka et al., 2023), potentially overlooking the unique challenges and mechanisms present in smaller cities and rural areas, as well as non-US contexts (Fritsch & Wyrwich, 2021). Our study, therefore, highlights the importance of how psychological openness may serve as a key lever for overcoming the innovation paradox in less-developed regions.

Implications for Research

What are implications for the academic literature on firm innovation embedded in regions, particularly in peripheral and even 'left-behind' regions? First, our findings essentially support theorizing highlighting that it is not enough to look at local hard factors (e.g., the lagging structural hard factors in peripheral regions) – the role of local soft factors can be significant and requires a deeper understanding (Jacobs, 1969; Florida, 2002; Saxenian, 1994). We add to a growing body of empirical research directly measuring local psychological openness and its links to innovation mechanisms and outcomes (Mewes et al., 2022; Obschonka et al., 2023; Rutten, 2019; Tavassoli et al, 2021). Specifically, we make important contributions to this

literature by highlighting the cross-level mechanisms through which local psychological openness affects firm innovation, thereby connecting influential external and internal domains of the firm (Tavassoli & Karlsson, 2018; 2021; Cruz-Castro, et al. 2018). Such an interplay suggests that local psychological openness might drive firm innovation in particularly impactful ways in peripheral regions, offering insights that were previously unknown.

Second, while there is considerable emphasis in research on soft factors in well-endowed urban environments (e.g., Florida, 2002; Glaeser, 2011; Scott, 2006), there is a need for more theorizing and research into the specific psychology and culture of peripheral and left-behind regions. How can we better contextualize local firm innovation within the local macro-psychological makeup? This could include not only psychological openness but also other soft factors such as regional identity, collective memory, value and norms, or local narratives and cognitive reference points. Importantly, such research should focus on uncovering the idiosyncrasies of local cultures (see, for example, Rutten, 2019), rather than ranking regions across the same dimensions.

Implications for Policy

Many innovation policies focus on well-endowed areas as they are perceived to promise the best return on investment (Iammarino et al. 2019). Indeed, some economists explicitly advise against policies aimed at stimulating innovation in non-urban areas (Glaeser and Hausman 2019). At the same time, there is a strong political and public interest in addressing regional disparities and promote deeper change in left-behind regions (see MacKinnon et al., 2022; Rodríguez-Pose, 2018), despite growing evidence that this is difficult to achieve (OECD, 2013). Yet, this academic and public discourse is rather ignorant about the variety of context conditions (Nilsen et al., 2023; Pugh & Dubois, 2021), innovation potentials (Glückler et al., 2022), and development outcomes (Grillitsch et al., 2023) in peripheral regions. This directs attention

towards the deeper structural factors (e.g., hard or soft factors), which may promote innovation in the periphery.

By focusing on local psychological openness as a 'structural' soft factor, we shift the emphasis away from merely improving hard factors and towards perspectives that focus on local psychology and culture (Huggins & Thompson 2019; 2023), which may enhance local actors' ability to innovate and promote regional development (Grillitsch & Sotarauta, 2020), resonating with a more people-oriented focus (Jacobs, 1969). This implies that policy makers need to be aware of the local *cultural and psychological* evolution and path dependencies, not only the *economic* evolution and path dependencies (Martin & Sunley, 2006). Regional differences in soft factors might be rather persistent due to a form of 'institutional stickiness' that deeply shapes the economic outcomes and trajectories of regions (Fritsch & Storey, 2014; Guiso et al., 2016; Huggins & Thompson, 2019; Tabellini, 2010). As highlighted by North (1994, p. 364): "it is culture that provides the key to path dependence". So, it does not only seem very difficult to change local culture in the short term because of its 'stickiness', there are also important ethical considerations (e.g., social engineering due to economic goals, Huggins & Thompson, 2023). Moreover, there is evidence that top-down strategies (e.g., policies) aimed at changing local culture (e.g., "actions aimed at making a region less 'provincial'", Gambardella et al., 2009, p. 946) are problematic and ineffective. The top-down imposition of simplified, standardized schemes by states and large organizations often ignores the complex, organic, and context-specific dynamics embedded within local cultures and practices (Scott, 1998).

However, while it may be difficult and ethically challenging to attempt to change local culture, our study also informs policies by suggesting they could focus on the actual mechanisms through which local psychological openness shapes firm innovation. Instead of targeting local psychological openness and thereby interfering with the psychological fabric of

a region (e.g., identity, cultural practices, values and norms, Oishi, 2014), policies could leverage innovation mechanisms highlighted in our study, such as improving the absorptive capacity of peripheral regions and the firms within these regions in ways other than altering local psychological openness. Recent research indicates, for example, that social connectedness to highly innovative places can play an important role in this process, through knowledge spillovers and learning (Obschonka et al., 2023). Hence, by maintaining a people-focused approach, policies could invest in *social* infrastructure rather than interfering with the local cultural/psychological makeup that is the result of the region's cultural and psychological evolution.

Finally, another policy implication of our study is that local hard factors often interact with local soft factors in characteristic ways. Therefore, policies targeting local hard factors should indeed consider the people-side, as these factors do not operate in a social vacuum. One strategy could be some form of smart specialization (Gianelle et al., 2020), where the local cultural and psychological profile informs the most effective decisions regarding investments in local hard factors (e.g., investing in such hard factors that best align with the existing soft factors).

REFERENCES

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and Innovation: An Inverted U Relationship. *Quarterly Journal of Economics*.

Alcácer, J. and W. Chung (2007), Location Strategies and Knowledge Spillovers, *Management Science*, 53, 760-776.

Asheim, B., & Gertler, M. S. (2005). *The Geography of Innovation: Regional Innovation Systems*. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), The Oxford Handbook of Innovation (pp. 291-317). Oxford University Press.

Audretsch, D. B., & Feldman, M. P. (1996). R&D spillovers and the geography of innovation and production. *The American Economic Review*, *86*(3), 630-640.

Baldwin, C. Y., Bogers, M. L., Kapoor, R., & West, J. (2024). Focusing the ecosystem lens on innovation studies. *Research Policy*, *53*(3), 104949.

Bischoff, T. S., Runst, P., & Bizer, K. (2024). Spatial heterogeneity in the effect of regional trust on innovation. *Economic Geography*, *100*(1), 80-101.

Bogers, M., Foss, N. J., & Lyngsie, J. (2018). The “human side” of open innovation: The role of employee diversity in firm-level openness. *Research Policy*, 47(1), 218-231.

Boschma, R. A., & Fritsch, M. (2009). Creative class and regional growth: Empirical evidence from seven European countries. *Economic geography*, *85*(4), 391-423.

Chang, S., Gong, Y., Way, S. A., & Jia, L. (2013). Flexibility-oriented HRM systems, absorptive capacity, and market responsiveness and firm innovativeness. *Journal of Management*, 39(7), 1924-1951.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 128-152.

Cohen, W.M., and Klepper, S. (1996). Firm Size and the Nature of Innovation within Industries: The Case of Process and Product R&D. *Review of Economics and Statistics*.

Connelly, B. L., Certo, S. T., Ireland, R. D., & Reutzel, C. R. (2011). Signaling theory: A review and assessment. *Journal of Management*, 37(1), 39-67.

Cooke, P. (1992). Regional innovation systems: competitive regulation in the new Europe. *Geoforum*, 23(3), 365-382.

Cruz-Castro, L., Holl, A., Rama, R., & Sanz-Menéndez, L. (2018). Economic crisis and company R&D in Spain: do regional and policy factors matter?. *Industry and Innovation*, *25*(8), 729-751.

Di Stefano, G., A. Gambardella, and G. Verona. (2012). Technology Push and Demand Pull Perspectives in Innovation Studies: Current Findings and Future Research Directions. *Research Policy* 41 (8), 1283–95.

Duranton, G., & Puga, D. (2001). Nursery cities: urban diversity, process innovation, and the life cycle of products. *American Economic Review*, *91*(5), 1454-1477.

Ebert, T., Götz, F. M., Mewes, L., & Rentfrow, P. J. (2022). Spatial analysis for psychologists: How to use individual-level data for research at the geographically aggregated level. *Psychological Methods*.

Elster, J. 1978. *Logic and society: Contradictions and possible worlds*. London: Wiley.

Falck, O., Fritsch, M., & Heblich, S. (2011). The phantom of the opera: Cultural amenities, human capital, and regional economic growth. *Labour Economics*, *18*(6), 755-766.

Feldman, M. P. (1994). The Geography of Innovation (Vol. 2). Springer Science & Business Media.

Feldman, M., & Tavassoli, S. (2015). *Something New: Where do New Industries Come from?*. In Oxford Handbook of Local Competitiveness. Oxford University Press.

Fitjar, R.D. and A. Rodríguez-Pose (2011), When local interaction does not suffice: sources of firm innovation in urban Norway, *Environment and Planning. A*, 43, 1248-1267.

Florida, R. (2002). *The rise of the creative class* (Vol. 9). New York: Basic books.

Franco, C., & Landini, F. (2022). Organizational drivers of innovation: The role of workforce agility. *Research Policy*, 51(2), 104423.

Fritsch, M., & Storey, D. J. (2014). Entrepreneurship in a regional context: Historical roots, recent developments and future challenges. *Regional Studies*, *48*(6), 939-954.

Fritsch, M., & Wyrwich, M. (2021). Is innovation (increasingly) concentrated in large cities? An international comparison. *Research Policy*, *50*(6), 104237.

Gambardella, A., Mariani, M., & Torrisi, S. (2009). How 'provincial'is your region? Openness and regional performance in Europe. *Regional Studies*, *43*(7), 935-947.

Garretsen, H., Stoker, J. I., Soudis, D., Martin, R., & Rentfrow, J. (2019). The relevance of personality traits for urban economic growth: Making space for psychological factors. *Journal of Economic Geography*, *19*(3), 541-565.

Gertler, M. S. (2010) Rules of the game: the place of institutions in regional economic change. Regional Studies, 44: 1–15.

Gianelle, C., Kyriakou, D., McCann, P., & Morgan, K. (2020). Smart Specialisation on the move: reflections on six years of implementation and prospects for the future. *Regional Studies*, *54*(10), 1323-1327.

Glaeser, E. L. (2011). Triumph of the City – How Our Greatest Invention Makes us Richer, Smarter, Greener, Healthier and Happier. Penguin Press, New York.

Glaeser, E. L., & Hausman, N. (2020). The spatial mismatch between innovation and joblessness. *Innovation Policy and the Economy*, *20*(1), 233-299

Glaeser, E.L.; H.D. Kallal; J. Scheinkman, A. ; and A. Shleifer (1992), Growth in Cities,

Journal of Political Economy, 100, 1126-1152.
Glückler, J.; R. Shearmur; and K. Martinus (2022), Liability or opportunity? Reconceptualizing the periphery and its role in innovation, *Journal of Economic Geography*, 23, 231-249
Grillitsch, M. and M. Nilsson (2015), Innovation in peripheral regions: Do collaborations compensate for a lack of local knowledge spillovers?, *The Annals of Regional Science*, 54, 299-321.
Grillitsch, M. and M. Sotarauta (2020), Trinity of change agency, regional development paths and opportunity spaces, *Progress in Human Geography*, 44, 704-723.
Grillitsch, M.; M. Sotarauta; B. Asheim; R.D. Fitjar; S. Haus-Reve; J. Kolehmainen; H. Kurikka; K.-J. Lundquist; M. Martynovich; S. Monteilhet; H. Nielsen; M. Nilsson; J. Rekers; S. Sopanen; and L. Stihl (2023), Agency and economic change in regions: identifying routes to new path development using qualitative comparative analysis, *Regional Studies*, 57, 1453-1468.
Guiso, L., Sapienza, P., & Zingales, L. (2016). Long-term persistence. *Journal of the European Economic Association*, *14*(6), 1401-1436.
Haddad, C., & Benner, M. (2021). Situating innovation policy in Mediterranean Arab countries: A research agenda for context sensitivity. *Research Policy*, *50*(7), 104273.
Howoldt, D. (2024). Characterising innovation policy mixes in innovation systems. *Research Policy*, *53*(2), 104902.
Huggins, R., & Thompson, P. (2019). The behavioural foundations of urban and regional development: Culture, psychology and agency. *Journal of Economic Geography,* 19(1), 121-146.
Huggins, R., & Thompson, P. (2023). Uneven development, competitiveness and behavioural economic geography: Addressing 'levelling up' policies from a human perspective. *Regional Science Policy & Practice*, *15*(9), 2274-2294.
Iammarino, S.; A. Rodriguez-Pose; and M. Storper (2019), Regional inequality in Europe: evidence, theory and policy implications, *Journal of Economic Geography*, 19, 273-298.
Inglehart, R., & Baker, W. E. (2000). Modernization, Cultural Change, and the Persistence of Traditional Values. A*merican Sociological Review*, 65(1), 19-51.
Jacobs, J. (1961). The Death and Life of Great American Cities. Vintage.
Jacobs, J. (1969). The economy of the cities.
Lee, N. (2017). Psychology and the geography of innovation. *Economic Geography*, *93*(2), 106-130.
Lee, N. (2024). *Innovation for the Masses: How to Share the Benefits of the High-tech Economy*. Univ of California Press.
MacKinnon, D., Kempton, L., O'Brien, P., Ormerod, E., Pike, A., & Tomaney, J. (2022). Reframing urban and regional 'development'for 'left behind'places. *Cambridge Journal of Regions, Economy and Society*, *15*(1), 39-56.
Martin, R. L. (2000) Institutionalist approaches in economic geography, Chap 5. In E. Sheppard and T. Barnes (eds) A Companion to Economic Geography, pp. 77–94. Oxford: Blackwell.
Martin, R., & Sunley, P. (2006). Path dependence and regional economic evolution. *Journal of Economic Geography*, *6*(4), 395-437.
Mewes, L., Ebert, T., Obschonka, M., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2022). Psychological openness and the emergence of breakthrough vs. incremental innovations: A regional perspective. *Economic Geography*, 98(4), 379-410.
Nilsen, T.; M. Grillitsch; and A. Hauge (2023), Varieties of periphery and local agency in regional development, *Regional Studies*, 57, 749-762
North, D. C. (1994). Economic performance through time. *The American Economic Review*, *84*(3), 359-368.
Obschonka, M., Tavassoli, S., Rentfrow, P. J., Potter, J., & Gosling, S. D. (2023). Innovation and inter-city knowledge spillovers: Social, geographical, and technological connectedness and psychological openness. *Research Policy*, 52(8), 104849.

Obschonka, M., Grillitsch, M., Guldåker, N., Rauhut, D., Rentfrow, R.J., Potter, J., & Gosling, S.D. (2025). A Nation of Contrast? The Geography of Personality in Sweden, Regional Polarization, and a Research Agenda. *Papers in Innovation Studies*, Nr. 2025/06, CIRCLE Working Paper Series, Lund University.

OECD (2013). *Innovation-driven Growth in Regions: The Role of Smart Specialisation*. OECD Regional Development Working Papers.

Oishi, S. (2014). Socioecological psychology. *Annual Review of Psychology*, *65*(1), 581-609.

Oughton, C.; M. Landabaso; and K. Morgan (2002), The Regional Innovation Paradox: Innovation Policy and Industrial Policy, *The Journal of Technology Transfer*, 27, 97-110.

Pato, M. L., & Teixeira, A. A. (2016). Twenty years of rural entrepreneurship: A bibliometric survey. S*ociologia ruralis*, 56(1), 3-28.

Peck, J. (2005). Struggling with the creative class. *International journal of urban and regional research*, *29*(4), 740-770.

Peters, M., M. Schneider, T. Griesshaber, and V. H. Hoffmann (2012) The Impact of TechnologyPush and DemandPull Policies on Technical Change—Does the Locus of Policies Matter?"*Research Policy* 41 (8), 1296–1308.

Pike, A., Béal, V., Cauchi-Duval, N., Franklin, R., Kinossian, N., Lang, T., ... & Velthuis, S. (2024). 'Left behind places': a geographical etymology. *Regional Studies*, *58*(6), 1167-1179.

Pfotenhauer, S. M., Wentland, A., & Ruge, L. (2023). Understanding regional innovation cultures: Narratives, directionality, and conservative innovation in Bavaria. *Research Policy*, *52*(3), 104704.

Pugh, R. and A. Dubois (2021), Peripheries within economic geography: Four "problems" and the road ahead of us, *Journal of Rural Studies*, 87, 267-275.

Rentfrow, P. J. (2014). *Geographical psychology: Exploring the interaction of environment and behavior* (pp. xi-343). American Psychological Association.

Rentfrow, P. J., Gosling, S. D., & Potter, J. (2008). A theory of the emergence, persistence, and expression of geographic variation in psychological characteristics. *Perspectives on Psychological Science*, *3*(5), 339-369.

Rutten, R. (2019). Openness values and regional innovation: a set-analysis. *Journal of Economic Geography*, *19*(6), 1211-1232.

Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128*. Cambridge: Harvard University Press.

Scott, A. J. (2006). Creative cities: Conceptual issues and policy questions. *Journal of urban affairs*, 28(1), 1-17.

Qian, H., & Acs, Z. (2013). An Absorptive Capacity Theory of Knowledge Spillover Entrepreneurship. *Small Business Economics*, 40.

Robertson, P. L., Casali, G. L., & Jacobson, D. (2012). Managing open incremental process innovation: absorptive capacity and distributed learning. *Research Policy*, 41(5), 822-832.

Rodríguez-Pose, A. (2018). The revenge of the places that don't matter (and what to do about it). *Cambridge Journal of Regions, Economy and Society*, *11*(1), 189-209.

Rutten, R. (2019). Openness values and regional innovation: a set-analysis. *Journal of Economic Geography*, *19*(6), 1211-1232.

Schmookler, Jacob. *Invention and Economic Growth*. Harvard University Press, 1966.

Scott, J. C. (2020). *Seeing like a state: How certain schemes to improve the human condition have failed*. Yale University Press.

Tabellini, G. (2010). Culture and institutions: economic development in the regions of Europe. *Journal of the European Economic Association*, *8*(4), 677-716.

Tavassoli, S., & Karlsson, C. (2018). The role of regional context on innovation persistency of firms. *Papers in Regional Science*, 97(4), 931-956.

Tavassoli, S., Obschonka, M., & Audretsch, D. B. (2021). Entrepreneurship in cities. *Research Policy*, 50(7), 104255.

Tojeiro-Rivero, D., & Moreno, R. (2019). Technological cooperation, R&D outsourcing, and innovation performance at the firm level: The role of the regional context. *Research Policy*, 48(7), 1798-1808.

Von Hippel, E. (1986). Lead users: a source of novel product concepts. *Management science,* 32(7), 791-805.

Figure 1: Number of observations per municipality

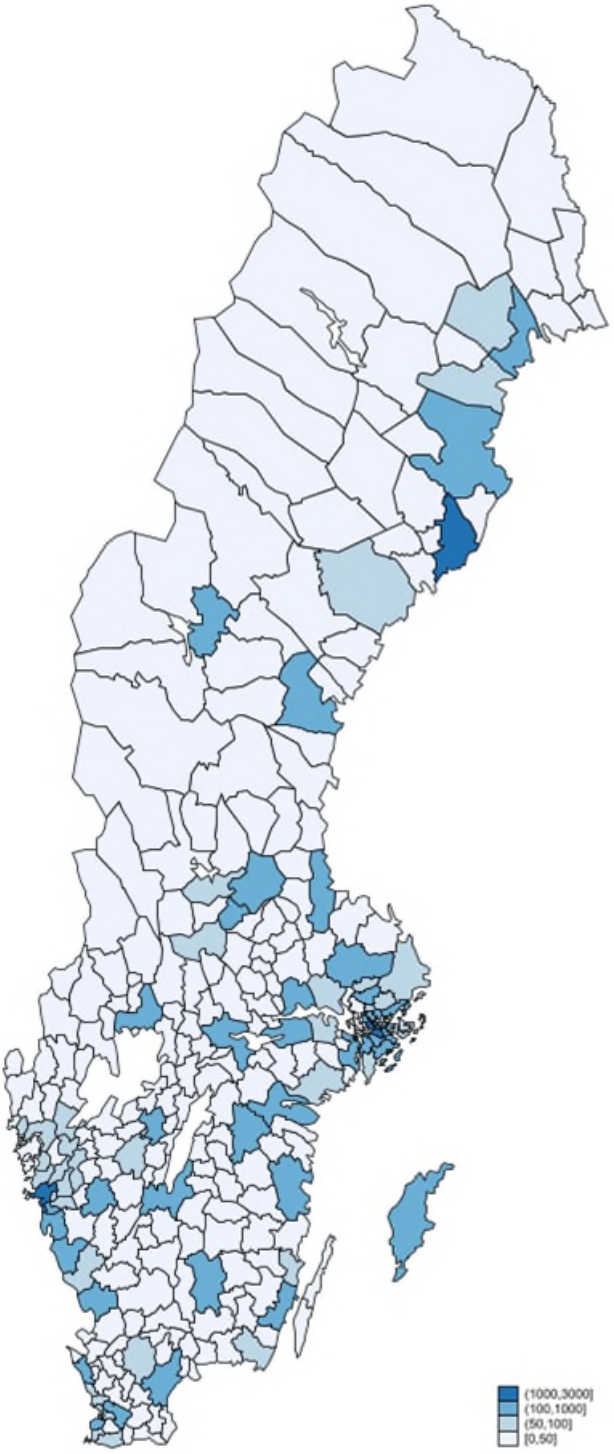


Table 1: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11
(1) Firm innovation	0.365	0.481	0	1	1.000										
(2) Local openness	3.704	0.115	3.433	3.847	0.049	1.000									
(3) Local agreeableness	3.648	0.049	3.489	3.764	-0.003	-0.225	1.000								
(4) Local extraversion	3.326	0.073	3.117	3.598	0.009	0.229	0.385	1.000							
(5) Local conscientiousness	3.402	0.047	3.214	3.531	0.007	0.040	0.449	0.396	1.000						
(6) Local neuroticism	2.818	0.063	2.616	3.021	0.004	0.006	-0.416	-0.449	-0.359	1.000					
(7) Local population	12.202	1.044	10.481	13.749	0.018	0.792	-0.054	0.306	0.058	-0.020	1.000				
(8) Local knowledge intensity	0.385	0.071	0.227	0.571	0.052	0.668	0.034	0.152	0.224	-0.061	0.604	1.000			
(9) Firm knowledge intensity	0.295	0.274	0	1	0.202	0.291	-0.044	0.054	0.066	-0.006	0.282	0.355	1.000		
(10) Firm size	3.748	1.462	0	10.585	0.169	0.099	-0.009	-0.005	0.031	-0.003	0.074	0.101	0.007	1.000	
(11) Firm profitability	0.000	0.003	-0.017	0.406	-0.006	-0.005	0.013	0.007	0.004	-0.007	-0.001	-0.001	-0.006	-0.012	1.000

Number of observations for all variables: 21049

Table 2: Baseline effects of local openness, knowledge-related endowment, and firm factors on firm innovation

	Model 2a	Model 2b	Model 2c	Model 2d
Local soft factors				
Local openness	0.4430***	0.4868***	0.3904*	0.2254
	(0.1169)	(0.1284)	(0.2318)	(0.2205)
Local agreeableness		0.1149	-0.0450	0.0887
		(0.3262)	(0.3390)	(0.3233)
Local extraversion		-0.2300	0.1693	0.3550
		(0.2257)	(0.2348)	(0.2257)
Local conscientiousness		0.1654	-0.3953	-0.5977*
		(0.3176)	(0.3293)	(0.3193)
Local neuroticism		0.0705	0.1489	0.1415
		(0.2392)	(0.2412)	(0.2353)
Local knowledge-related endowment				
Local population			-0.0861***	-0.1044***
			(0.0213)	(0.0203)
Local knowledge intensity			1.6544***	0.7248**
			(0.3211)	(0.3089)
Firm factors				
Firm knowledge intensity				1.0000***
				(0.0560)
Firm size				0.1677***
				(0.0089)
Firm profitability				-29.0651
				(32.5599)
Industry dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Constant	-1.6828***	-2.2591	-0.5104	-0.5342
	(0.4312)	(1.7992)	(2.0554)	(1.9777)
Observations	21049	21049	21049	21049
Pseudo R^2	0.049	0.049	0.052	0.098
BIC	26455	26492	26429	25198

Probit regression, dependent variable is whether the firm generated a product or service innovation, standard errors in parentheses clustered by municipality, $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3: Effects of local openness on firm innovation conditional to local population, local knowledge intensity, and firm knowledge intensity

	Model 3a	Model 3b	Model 3c	Model 3d
Local soft factors				
Local openness	3.830**	1.786**	-2.723	-1.330
	(1.843)	(0.703)	(2.53)	(0.972)
Local agreeableness	-0.070	-0.052	-0.014	0.007
	(0.332)	(0.329)	(0.333)	(0.331)
Local extraversion	0.343	0.360	0.317	0.334
	(0.226)	(0.225)	(0.227)	(0.226)
Local conscientiousness	-0.562*	-0.560*	-0.562*	-0.605*
	(0.320)	(0.320)	(0.321)	(0.322)
Local neuroticism	0.016	0.016	-0.039	-0.043
	(0.242)	(0.240)	(0.242)	(0.240)
Local knowledge-related endowment				
Local population	1.082*	-0.091***	-1.073	-0.091***
	(0.602)	(0.021)	(0.828)	(0.021)
Local knowledge intensity	0.680**	16.980**	0.488	-17.162*
	(0.309)	(6.953)	(0.315)	(9.726)
Firm factors				
Firm knowledge intensity	0.996***	0.997***	-71.55***	-33.32***
	(0.055)	(0.055)	(25.82)	(9.759)
Firm size	0.167***	0.169***	0.166***	0.167***
	(0.008)	(0.008)	(0.008)	(0.01)
Firm profitability	-29.910	-29.556	-29.937	-29.58
	(32.213)	(32.205)	(31.254)	(31.245)
2-way interaction terms				
H1a: Local openness # local population	-0.3123**		0.269	
	(0.1584)		(0.218)	
H1b: Local openness # local knowledge intensity		-4.406**		4.87*
		(1.880)		(2.629)
Local openness # firm knowledge intensity			19.520***	9.417***
			(6.821)	(2.646)
Local population # firm knowledge intensity			6.394***	
			(2.201)	
Local knowledge intensity # firm knowledge intensity				99.06***
				(24.55)
3-way interaction terms				
H2a: Local openness # local population # firm knowledge intensity			-1.716***	
			(0.5793)	
H2b: Local openness# local knowledge intensity# firm knowledge intensity				-27.02***
				(6.615)
Industry dummies	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Constant	-13.358*	-5.732*	11.011	5.894
	(6.863)	(3.003)	(9.484)	(3.908)
Observations	21049	21049	21049	21049
Pseudo R^2	0.098	0.098	0.100	0.100
BIC	25201	25199	25190	25181

Probit regression, dependent variable is whether the firm generated a product or service innovation, standard errors in parentheses clustered by municipality, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 2A: Average marginal effects of openness on firm innovation conditional to local population (90% confidence intervals)

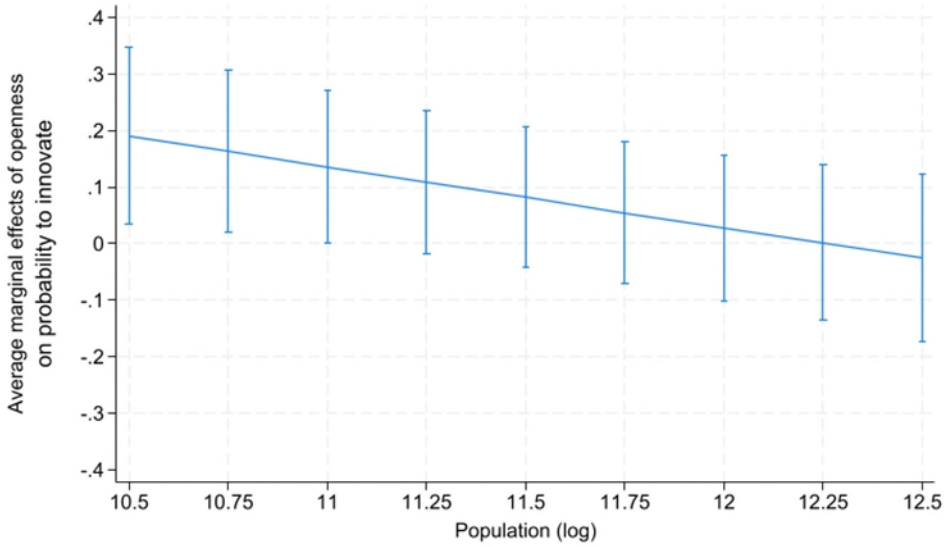


Figure 2B: Average marginal effects of openness on firm innovation conditional to local knowledge intensity (90% confidence intervals)

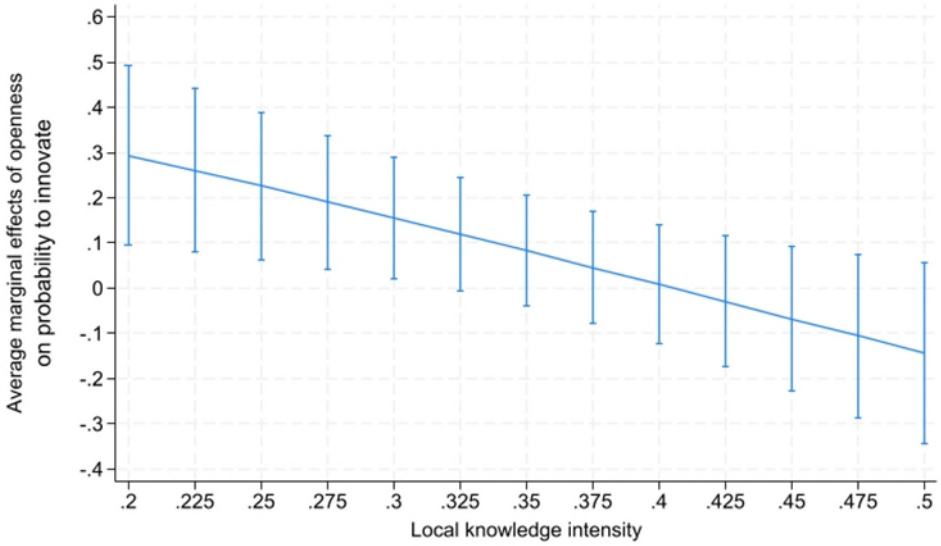


Figure 3A: Average marginal effects of local openness on firm innovation conditional to firm knowledge intensity in small vs large municipalities (90% confidence intervals)

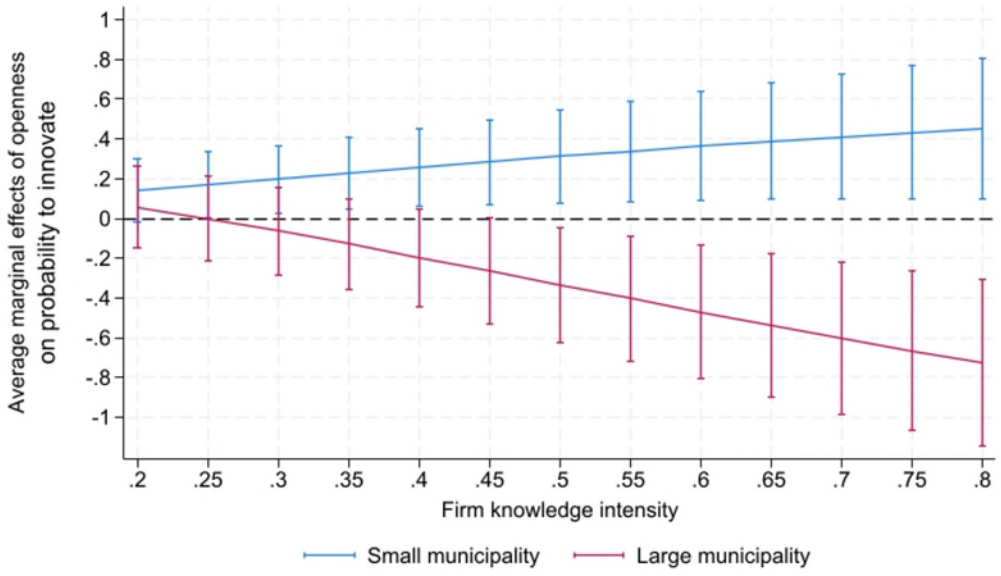
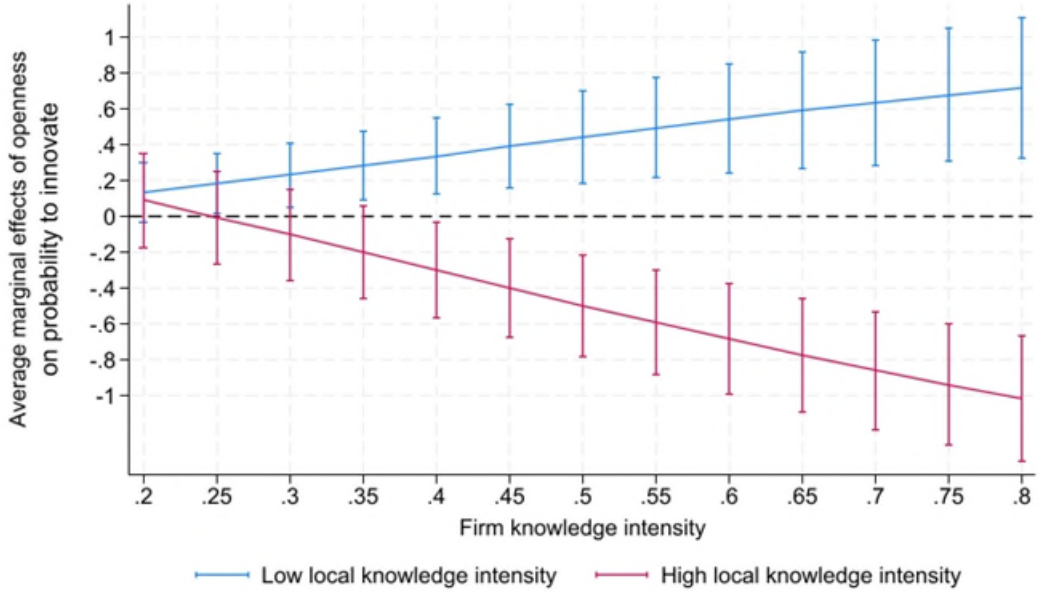
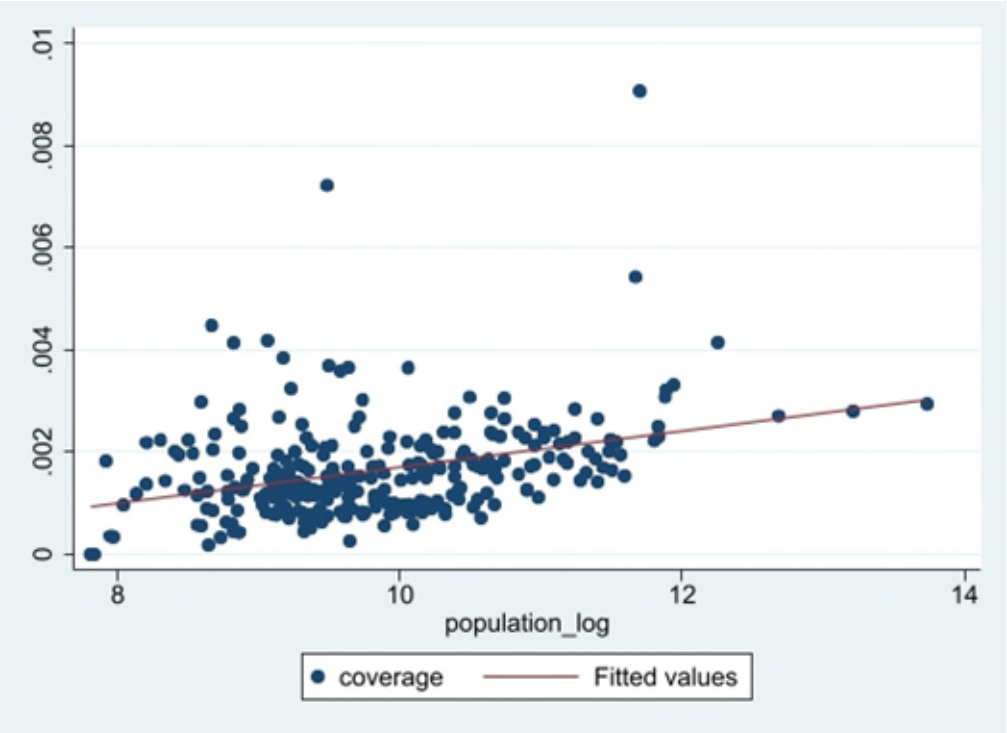


Figure 3B: Average marginal effects of local openness on firm innovation conditional to firm knowledge intensity for municipalities with low vs high knowledge intensity (90% confidence intervals)



Annex 1: Correlation between coverage of Big Five survey and population size of municipalities (log)



Annex 2: Big Five personality survey per municipality

Code	Municipality	Obs.	Population	coverage
180	Stockholm	2713	923516	0,00294
1480	Göteborg	1536	548190	0,00280
2480	Umeå	1095	120777	0,00907
1280	Malmö	873	322574	0,00271
380	Uppsala	872	210126	0,00415
1281	Lund	635	116834	0,00544
580	Linköping	506	152966	0,00331
1980	Västerås	468	145218	0,00322
1880	Örebro	444	144200	0,00308
581	Norrköping	343	137035	0,00250
1283	Helsingborg	317	137909	0,00230
680	Jönköping	296	133310	0,00222
1780	Karlstad	237	89245	0,00266
484	Eskilstuna	224	102065	0,00219
182	Nacka	220	97986	0,00225
184	Solna	217	76158	0,00285
2281	Sundsvall	217	97633	0,00222
126	Huddinge	206	105311	0,00196
1380	Halmstad	195	96952	0,00201
2580	Luleå	173	76088	0,00227
136	Haninge	168	83866	0,00200
1490	Borås	167	108488	0,00154
780	Växjö	165	88108	0,00187
2180	Gävle	163	98877	0,00165
123	Järfälla	159	72429	0,00220
880	Kalmar	159	65704	0,00242
181	Södertälje	158	93202	0,00170
160	Täby	148	68281	0,00217
2380	Östersund	146	61066	0,00239
2080	Falun	145	57062	0,00254
138	Tyresö	141	46177	0,00305
1383	Varberg	139	61030	0,00228
1290	Kristianstad	131	82510	0,00159
163	Sollentuna	130	70251	0,00185
2482	Skellefteå	128	72031	0,00178
127	Botkyrka	127	89425	0,00142
186	Lidingö	123	46302	0,00266
980	Gotland	123	57391	0,00214
1496	Skövde	122	53555	0,00228
2081	Borlänge	122	50988	0,00239
1481	Mölndal	120	63340	0,00189
117	Österåker	117	42130	0,00278
1384	Kungsbacka	114	79144	0,00144
883	Västervik	111	36049	0,00308
191	Sigtuna	103	44786	0,00230
381	Enköping	100	41893	0,00239
1482	Kungälv	100	42730	0,00234
1488	Trollhättan	100	57092	0,00175